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SEPTEMBER 20, 21, 22, 23, 24, 1937
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Volume XVIII APRIL, 1937 No. 4

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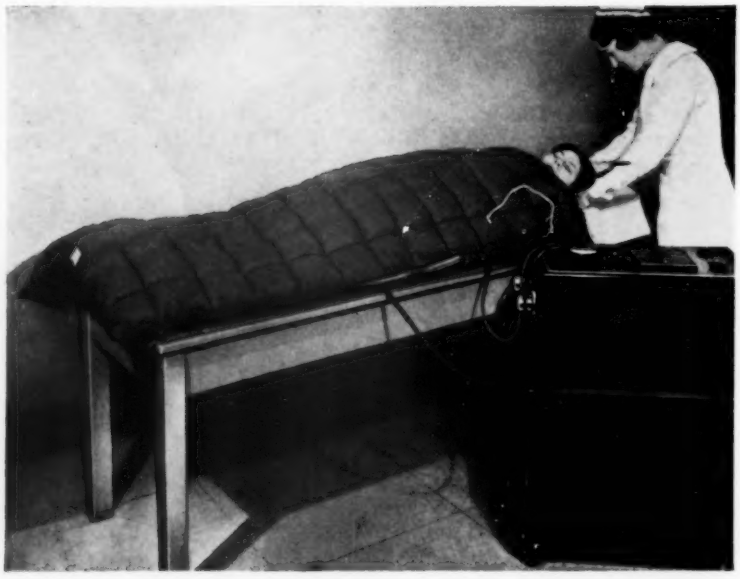

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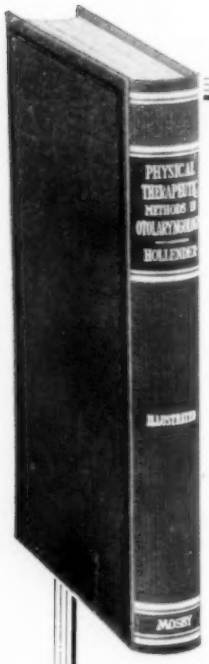

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THE BLANKET METHOD OF INDUCING ARTIFICIAL FEVER *

NORMAN N. EPSTEIN, M.D.

SAN FRANCISCO

In a previous paper[1] it was shown that artificial fever could be induced in patients simply by wrapping them in blankets and administering warm fluids by mouth. Further experience with this method indicates that it is practical and lends itself to general use. During the past two years, 355 fever treatments with the blanket method have been given at the Mount Zion Hospital, and 875 at the University of California Hospital, San Francisco. Several other hospitals in this region have adopted the method and have used it successfully.

It is the purpose of this report to describe this method of inducing artificial fever as it is now employed, and to point out the untoward reactions which may occur during its administration.

The candidate for pyrotherapy may be an ambulatory or a hospital patient. The treatment requires twenty-four hours of hospitalization. The patient enters the hospital in the morning, receives his treatment during that day, and leaves the next morning when he is usually able to return to his work.

A thorough physical examination is made before the patient is accepted for pyrotherapy. This is repeated before each treatment. Any serious cardiovascular lesion, hypertension, obesity, an intercurrent infection, advanced age, or any other grave physical defect is regarded as contraindication for fever therapy. The blood pressure and weight are recorded before and after each treatment.

Technic

Upon admission to the hospital the patient, nude, is placed upon a bed which is covered with a thin bath blanket, a rubber sheet, a canvas sheet and two heavy woolen blankets. These are large enough to be completely wrapped around the patient. The heels are covered with a gauze pad, and long heavy woolen socks are drawn over the feet and legs. The patient is then wrapped with thin bath blankets in such a way that no portion of the body is exposed except the face. The limbs and trunk are covered separately, and one blanket is brought over the head as a hood. This procedure requires five blankets.

A common electric body frame containing twelve 60-watt carbon lamps is then placed over the patient. This is used to accelerate the initial rise in temperature. The frame should be made of light material, and the patient protected from the lamps by a coarse wire netting. It should be large enough to cover about two-thirds of an ordinary hospital bed.

The heavy woolen blankets under the patient are brought over the appliance, forming a closed cabinet. The lights are turned on, and the patient's temperature rises promptly — that is, within two hours — to 40 degrees C. (104 degrees F.) (figs. 1 and 2). The apparatus is then removed, and the patient is wrapped, successively, in the rubber sheet, the canvas sheet and the two heavy woolen blankets. This should be done in such a manner

* From the Department of Dermatology of the Mount Zion Hospital and the Division of Dermatology, Department of Medicine, of the University of California Medical School.

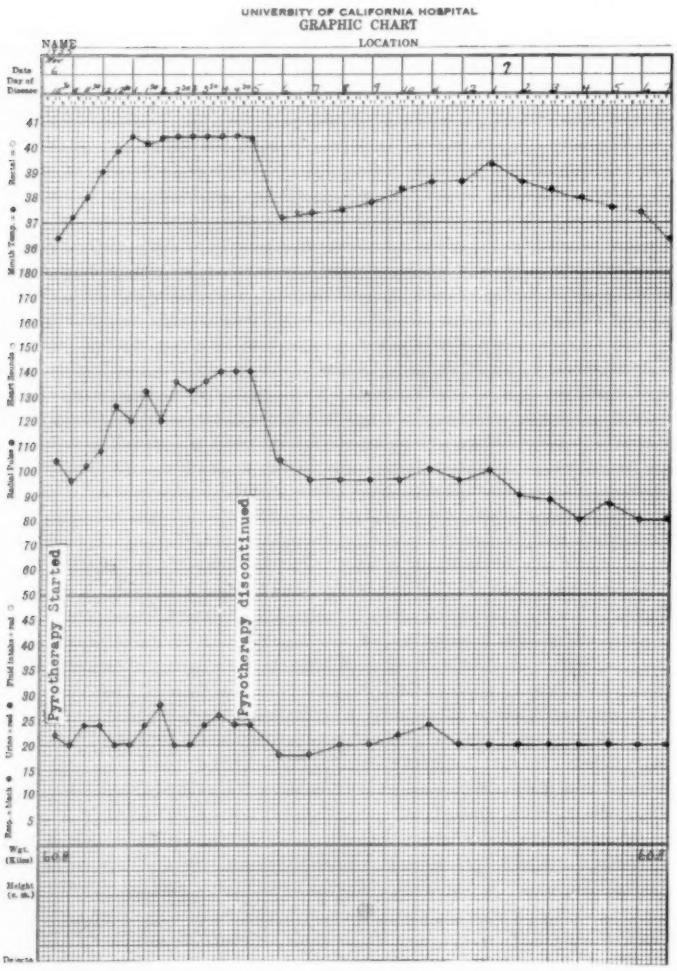

Fig. 1. — Secondary rise of temperature several hours after treatment is discontinued.

that he is completely enclosed in the pack. However, the wrappings should be loose enough to permit some freedom of movement.

Following the removal of the apparatus, the patient remains in the blanket-pack for the duration of the treatment. The usual treatment is five hours with a temperature of over 39.5 degrees C. (103.1 degrees F.); but this will vary with each condition. As a rule the entire treatment requires seven hours. While the patient is in the blanket-pack, the temperature tends to rise gradually. When it reaches the desired height, it can be maintained at that level easily by loosening the blankets for a time.

The session is discontinued by removing the blanket-pack, changing the bedclothes and bathing the patient. The temperature falls to normal usually within one hour and a half.

Administration of Fluids During Treatment. — The patient is given, orally, 200 c.c. of a mixture of wheat-gruel, salt and glucose every half-hour during the seance. This mixture contains 15 grams of thoroughly cooked wheat cereal, 40 grams of sugar and 10 grams of sodium chloride per 1,000 c.c. It is administered warm, the temperature ranging between 40 to 45 degrees C. (104-113 degrees F.). During a single treatment the patient will take

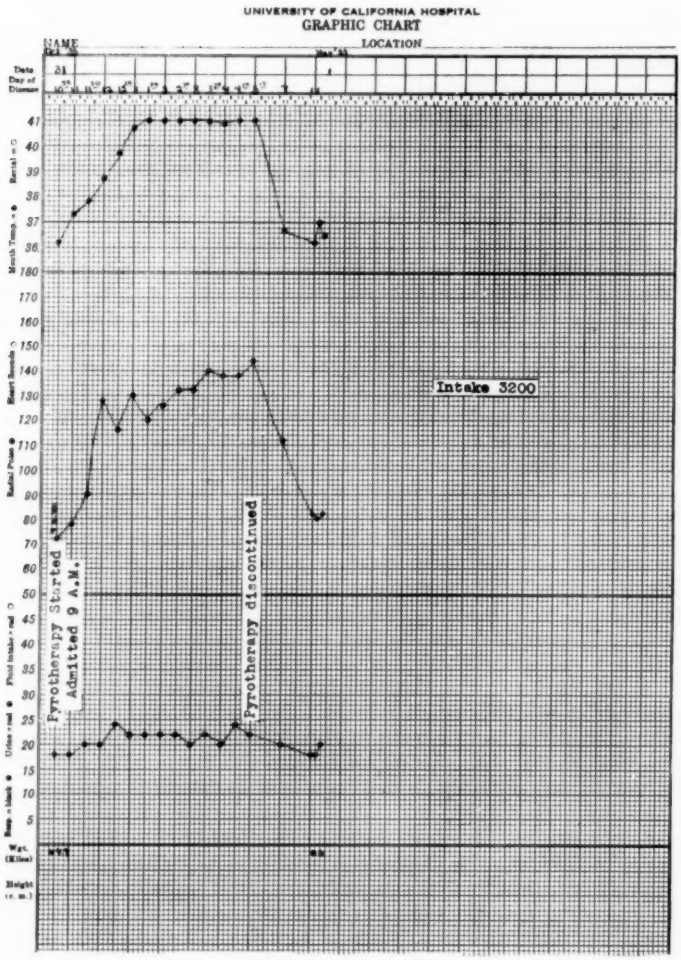

Fig. 2. — Usual temperature rise to 41 degrees C. (105.8 degrees F.) maintained for four hours.

from 3,000 to 4,500 c.c. of this mixture. In a series of 215 treatments the average fluid intake was 3,567 c.c. In the event that fluids are not taken well by mouth, an intravenous injection of 1,000 c.c. of normal saline solution containing 5 per cent glucose should be given at the beginning and the conclusion of the treatment.

The importance of the fluid intake should be emphasized. The replacement of the fluid and chloride lost through perspiration is essential. Patients who take a sufficient amount of the fluid mixture tolerate the treatment much better than those who do not take fluids well.

Reading Patient's Temperature. — The oral or axillary temperature is taken at fifteen-minute intervals throughout the treatment. At the conclusion of the treatment, the temperature is taken at half-hour intervals until it becomes normal, and then hourly until the patient is discharged. The pulse is counted at the temple.

These methods of recording the temperature have been found entirely satisfactory except when the patient does not cooperate or is not reacting normally to the treatment. In these instances the rectal temperature is taken.

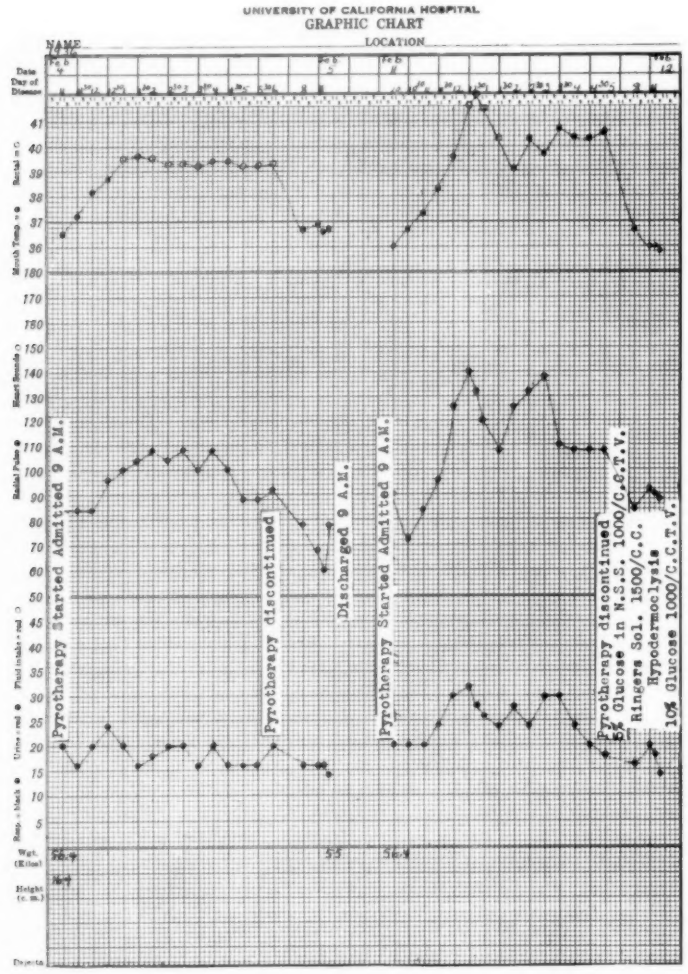

Fig. 3. — (Feb. 11, 1936). Sudden rise of temperature to 42 degrees C. (107.6 degrees F.).

The temperature should be taken at 5-minute intervals in the presence of some untoward reaction.

When taking the oral temperature, it is important that the mouth be moist and that the thermometer be in good contact with the tissues. The oral temperature should not be taken immediately after a warm drink. In taking oral, axillary or rectal temperatures, the thermometer should be left in place for five minutes before reading. The axillary temperature is accurate, and is the most practical method of recording the temperature while the patient is in the blanket-pack. The rectal temperature is, however, the most reliable method. In taking the rectal temperature, the blankets should be disturbed as little as possible.

Figure 3 and table 1 show the comparative oral, axillary and rectal temperatures. The axillary and oral temperatures are almost identical, seldom varying more than 0.1 degree C., while the rectal temperature varies from 0.3 to 0.4 degree C. higher than the oral or axillary temperatures.

Table 2 shows the relative temperatures of the mouth, axilla and the blanket-pack after the apparatus has been removed.

TABLE 1. — *Comparative Studies of Oral, Axillary and Rectal Temperatures.*

Time	Oral Temp. C.	Axillary Temp. C.	Rectal Temp. C.
12:00	40.1	40.1	40.5
12:30	40.5	40.5	40.9
1:00	40.7	40.7	41.1
1:30	40.9	40.9	41.4
2:00	40.9	40.9	41.4
2:30	40.9	40.9	41.4
3:00	40.9	40.8	41.3
3:30	40.8	40.8	41.2
4:00	40.8	40.8	41.3
4:30	40.8	40.8	41.3

TABLE 2. — *Studies of Relative Temperature of Mouth, Axilla and Blanket-Pack.*

Time	Oral Temp. C.	Axillary Temp. C.	Blanket-Pack Temp. C.
1:30	40.1	40.1	40.3
2:00	40.3	40.4	40.3
2:30	40.3	40.5	40.6
3:00	40.5	40.6	40.7
3:30	40.5	40.5	40.6
4:00	40.6	40.6	40.7
4:30	40.6	40.6	40.6
5:00	40.7	40.7	40.7
5:30	40.6	40.6	40.6
6:00	40.5	40.5	40.6

Observation of Patient During Treatment. — During the period in which the patient's temperature is rising and until it again returns to normal, he is under constant observation by nurses trained in the procedure of fever therapy. The physician in charge of the ward remains available throughout the treatment.

As the temperature rises to 39 degrees C. (102.2 degrees F.), the patient usually becomes very restless, and a hypodermic injection of morphine sulphate gr. 1/4 and atropine sulphate gr. 1/150 is given. If necessary the morphine sulphate gr. 1/6 may be repeated within two hours.

General Tolerance of Fever Therapy

For the most part the fever treatments were tolerated well. There were no debilitating effects. In 122 treatments there was an average gain of weight of 0.8 kg.; and in 77 treatments there was an average loss of 1.5 kg. the morning following the treatment. In some patients after the usual series of ten weekly treatments there was a slight increase, while in others there was a slight loss in weight. In 125 treatments there was an average fall of 17 mm. mercury in the systolic blood pressure on the morning following the treatment. In no case did jaundice or severe anemia develop. There was little interference with the patient's economic status as the treatments required only one day per week from their work.

Untoward Reactions. — Artificial fever therapy is not without certain inherent risks. The development and maintainance of high temperatures over a period of hours places considerable physical strain upon the patient. The individual selected for pyrotherapy should be in good physical condition, but when the patient is obviously a poor risk, the treatment should be modified to meet the conditions.

The most serious reaction to artificial fever therapy is a sudden rise of the patient's temperature to dangerous heights: 41.5 to 43 degrees C. (106.7 to 109.4 degrees F.). This is accompanied by collapse, with unconsciousness. The blood pressure falls markedly, particularly the diastolic, and the pulse becomes very rapid and thready. This reaction can be prevented by con-

stant observation of the patient by nurses and physicians thoroughly familiar with the technic. The patient should not be left alone at any time during the entire treatment. These sudden rises in temperature are more likely to occur in advanced paretics or taboparetics. They do not occur as a rule when the temperature is maintained at 40 degrees C. (104 degrees F.) or lower. In the event that such a reaction develops, the blankets should be removed, and cold sponges and if necessary cold colonic irrigations should be given. Normal saline solution (1,000 c.c.) containing 5 per cent glucose solution should be administered intravenously. Calcium given intravenously is of value if tetanic convulsions are present. Caffeine hypodermically is also of benefit. Failure to reduce the patient's temperature may lead to a fatal issue. In two markedly deteriorated paretics, death took place. These two patients obviously were poor physical risks. Secondary rises in temperature may occur several hours after the treatment has been discontinued, and should be watched for.

In two patients a transient auricular fibrillation occurred during the treatment, which necessitated its discontinuance. Hematemesis took place in two patients. Nausea and vomiting are not unusual, but have been obviated to a large extent by the introduction of the wheat-gruel, salt and sugar mixture described above.

Herpes simplex about the nose, lips and mouth were noted in 92 per cent of our patients. The lesions had a tendency to be more severe where extreme high temperatures were maintained. Almost invariably they followed the first treatment of the series only; but in two instances they occurred after the first and second treatments. In two other patients herpes appeared after the first, second and third treatments. In one case the lesions appeared on the scalp, and in another on the right buttock, while in a third the herpes was on the left ear.

In several patients, burns of the skin of the heels were noted. These were thought to be due partly to the heat of the bed, partly to maceration of the skin, and partly to friction of the parts. These burns may be prevented to a large extent by protecting the heels with suitable gauze pads.

Comment

The method of inducing artificial fever described in this report is simple, available and controllable, and is adaptable for general use. It has the further advantage of requiring no expensive or complex apparatus. In a small ward with two nurses trained in fever therapy, we have been able to administer four treatments simultaneously.

Artificial fever therapy regardless of the method employed is a serious procedure with certain inherent risks. The candidate for fever therapy should be selected with considerable care and the risk to the individual carefully evaluated. This treatment should be carried out only by specially trained physicians and nurses and should be given only in properly equipped hospitals.

The large majority of our patients have been ambulatory, but a minimum period of twenty-four hours' hospitalization is required for each treatment. The number of treatments given, and the height and duration of temperature maintained depend upon the condition being treated. For neurosyphilis the patient is treated weekly for a series of ten treatments, during which time a total of fifty hours of fever over 39.5 degrees C. (103.1 degrees F.) are given. In this way the patient is able to continue at his work, requiring only one day a week off for his treatment.

Summary

1. The blanket method of inducing artificial fever is described.
2. The application of radiant heat and the prevention of loss of heat from the body surface are the principles employed in this method.
3. The simplicity, controllability, and the economy of the method are pointed out.
4. The reactions met with in artificial fever therapy are described.
5. Artificial fever therapy is a hospital procedure which should be carried out only by thoroughly trained physicians and nurses and only in properly equipped institutions.

Reference

1. Epstein, N. N., and Cohen, Maurice: The Effects of Hyperpyrexia Produced by Radiant Heat in Early Syphilis, J. A. M. A. **104**:883 (March 16) 1935.

CARBON ARC TREATMENT IN PULMONARY AND PLEURITIC TUBERCULOSIS *

ANDREW L. BANYAI, M.D.
WAUWATOSA, WIS.

It is stated by Underwood[1] that Kayser of Vienna was the first who in 1902 used artificial light for the treatment of pulmonary tuberculosis. Although light treatment is considered by many as an important adjunct to the treatment of extra-pulmonary tuberculosis, there is a considerable divergence of opinion concerning its value in pulmonary tuberculosis.

A concise summary of the more important reports on the chemical effect of ultraviolet rays was published by Halla.[2] Of the works cited by him, particular significance must be attributed to the studies of Fervers[3] on the favorable effect of light upon secondary anemia, and to the report of Raika[4] who found antiinflammatory substances in the erythematous skin areas that were produced by irradiation. Eidinow[5] thought that the curative effect of the ultraviolet rays is caused (1) by the production of a biochemical product in the tissue cells that is absorbed and causes an increased bactericidal power of the blood; (2) by a local counterirritation, hyperemia and tissue cell destruction; (3) by changes in the endocrine and vitamin balance. The idea was expressed by Luithlen[6] that the skin should be considered an endocrine organ, the stimulation of which must be regarded as an important part of the effect of irradiation upon the human body.

The therapeutic results in rickets led to the discovery that the cholesterol present in the human skin can be transformed into vitamin D. The significance of the production of vitamin D in the tuberculous can be appreciated if one thinks of its influence upon the calcium balance of the body. Spies[7] was able to produce calcification in experimental animals with large doses of vitamin D. Because of its antiinflammatory effect in allergic states, such as, urticaria, hay fever, and the like, it may not be unwarranted to believe that some of the allergic manifestations of tuberculosis might be affected favorably by raising the calcium level of the blood.

Spengler[8] is credited with being the first who in 1864 treated pulmonary

* From Muirdale Sanatorium, Wauwatosa, Wis.

tuberculosis with sunlight in a systematic and scientific manner. We have been using sunlight for extrapulmonary and pulmonary tuberculosis with satisfactory results. The reports of others who used artificial light for extrapulmonary tuberculosis complicating active, advancing type of pulmonary, tuberculosis were quite encouraging. On this basis we thought it rational to attempt the use of artificial light treatment in cases in which the pulmonary tuberculous lesion was of major importance, although some extrapulmonary focus complicated the situation, and also in cases of pulmonary tuberculosis without tuberculous complications.

Success or failure of this treatment hinges on the proper selection of cases. The most amenable are patients with minimal, moderately or far advanced tuberculosis whose temperature is not over 37.5 degrees C., and whose general condition and the condition of their blood are not beyond therapeutic approach. For this type the following indications have been established. (1) Local, mechanical measures, such as, artificial pneumothorax, phrenic nerve block, thoracoplasty cannot be performed; (2) if artificial pneumothorax or some other type of mechanical treatment was given, the result was not satisfactory; (3) preparatory to, or following thoracic surgery; (4) all cases of pleurisy with effusion after the disappearance of the acute symptoms; (5) patients who have secondary extrapulmonary tuberculosis; (6) patients whose pulmonary tuberculosis is associated with a chronic bronchitis or bronchiectasis.

Proliferative and fibrous types of pulmonary tuberculosis are ordinarily amenable to phototherapy. We found that carbon arc irradiation may be given not only without harm but with beneficial results to tuberculous patients of the exudative type, provided other indices, such as the temperature and the hematological condition do not preclude their eligibility. We have seen good therapeutic response in patients who had a caseous process of limited extent as estimated from the physical and roentgenologic findings and from the demonstration of cavities.

The presence of a small or a medium sized cavity should not be considered a contraindication, provided the patient's general condition is good and the defensive balance of the blood is favorable. As to the latter we recommend the sedimentation rate and the hemogram as useful aids for the estimation of the patient's immuno-pathologic status.

Hematologic Studies

From a study of 2000 consecutive cases we arrived at the following conclusions.[9] Active tuberculosis usually is accompanied by a disturbed colloidal balance of the blood that may be demonstrated by the increased sedimentation rate of the red blood cells. The activity of the process has a direct influence on the sedimentation rate. It is important to emphasize the toxicity of the infection rather than the size of the lesion as the main factor affecting the sedimentation rate. We observed many patients whose pulmonary involvement was extensive, yet whose sedimentation speed was comparatively slow; on the other hand, we often saw limited lesions with very rapid sedimentation. When toxic symptoms dominate, a rapid sedimentation rate can be expected. Fibrotic processes with less marked symptoms are less liable to show a great difference from normal, whereas virulent infections, with considerable soft infiltration, destruction and cavity formation, are accompanied by an abnormally rapid rate. If the periodic readings are plotted, a very low graph that corresponds to a very rapid rate, should always be considered an important sign of marked activity. We have frequently observed that the sedimentation rate was a more sensitive index of the presence of

large amounts of toxins in the body than the temperature or pulse rate. It seems desirable that a study of this test be included in the analysis of every case when patients are selected for light treatment. Patients with a very rapid sedimentation rate should be excluded from carbon arc lamp treatment. The greatest merit of the sedimentation test lies in its usefulness in observing the course of the disease, as a sensitive indicator of complications or the development of new foci, and as a criterion of the results of the treatment. The disappearance of toxic symptoms and the improvement of the patient's physical condition are accompanied by a sedimentation rate approaching normal. An increase in toxicity, progress of the disease and a continuously failing physical condition bring an increase in the speed of sedimentation. Periodic repetition of this test during the course of light treatment is of great value. It not only renders possible the early recognition of new foci in the lung that are often hidden to diagnostic approach, but, what is even more important, it offers an approximate gauge of the extent of improvement when physical or roentgen examination would be of little value.

In the analysis of the hemogram prior to the assignment of a patient to carbon arc lamp treatment, particular attention should be paid to findings that indicate toxicity, such as, a leucocytosis, a shift to the left in the Arneth or Schilling count (the increase in the number of immature neutrophile leucocytes), and an increase in the monocyte-lymphocyte ratio.

Therapeutic Indications

A history of pulmonary hemorrhage should not be a contraindication if the case is a suitable one from the clinical standpoint. This incident is not more frequent in patients who are taking light treatment than in patients with the same type of disease without light treatment. Moderate exposures to ultraviolet rays increase the coagulability of the blood.

Carbon arc irradiation is contraindicated in patients having fever, a rapidly advancing type of pulmonary tuberculosis, multiple or large sized cavities (more than 3 cm. in diameter), poorly compensated heart, marked general debility, amyloidosis, very rapid sedimentation rate, and unfavorable hematologic findings, such as high leucocytosis, marked shift to the left and a very high monocyte-lymphocyte ratio. Until now we have excluded patients with high blood pressure. This attitude, however, should be modified in view of a recent publication by Laurens.[10] He was able to produce a reduction of the systolic and diastolic blood pressure in hypertensive cases by moderate, repeatedly applied carbon arc irradiations.

Caution is a prerequisite to correct carbon arc treatment. Overdosage may be as harmful as that with arsphenamine, insulin, morphin. Unfortunately we do not have a standard of medication. All experienced workers emphasize the importance of individualization. There is no concrete gauge for measuring the prospective absorption of the light energy by the skin and the penetration of the light rays through the skin. There is also no accurate method for determining the amount and nature of the therapeutic factors produced by the rays and the body's subsequent response to irradiation. The only rational procedure, therefore, is the adaptation of the treatment to the patient and not to force the patient into any fixed schedule.

If it is assumed that light treatment causes a hyperemic reaction at the periphery of the diseased area in the lung, and a certain amount of "tuberculin-like substance" is liberated thereby, caution must be exercised that such a reaction should not be too intense, because it might lead to a rapid breakdown of the involved tissues, instead of aiding the resistance and defense and accelerating repair.

We have used a two-lamp unit of the "Eveready" solarium type carbon arc lamp with "Eveready" therapeutic "C" carbons. The lamp was operated on 60 amperes at each arc. The "C" carbon is a polymetallic type of carbon in which according to the manufacturer, iron, nickel, silicon and aluminum are used. Its radiation is particularly strong in the so-called antirachitic zone, from 2700 to 3000 Ångström units. It is relatively weak in the penetrating light and heat zones. The focal distance was 2 meters.

Patients under our care received a graded exposure somewhat similar to the scheme laid down by Rollier. On the first day only the feet were exposed for five minutes. On the second day the feet were exposed for ten minutes, and the legs below the knees for five minutes. On the third day the feet were exposed for fifteen, the legs up to knees for ten, and the thighs for five minutes. On the fourth day the exposure of each of these areas was increased by five minutes, and a five minute irradiation of the abdomen below the costal arch was added. On the fifth day the chest was exposed for five minutes, while the exposure time over the already exposed areas was increased by five minutes. From then on each part of the body was exposed for five minutes more each day until half an hour irradiation of the entire body except the head was reached. The exposure time was equally divided between the anterior and posterior aspects of each zone and the entire body. By having the patients turn every minute until a fifteen minute exposure of the chest is reached, and from then on in every five minutes, an even irradiation of the body is insured. Patients who were very sensitive to light were given treatments only every other day. In some the exposure time was reduced to a maximum of fifteen minutes of daily general irradiation. It was suggested by others that either the surface area exposed to light rays can be limited or the distance from the lamp can be increased in such cases. Dividing the exposure time into two to four periods by a half hour rest outside of the light, is not a feasible procedure for group therapy.

The treatments were given under the supervision of a trained nurse. She was instructed to follow a set of rules including graded exposure, protection of the head by linen caps, wearing of goggles for the protection of the eyes, and observing the patient for possible erythema. All treatments were given in the recumbent position. No treatment was given when erythema persisted longer than 24 hours, and were resumed only after the clearing of the erythema. Members of the medical staff were instructed to keep a careful check upon the pulse and temperature, and to observe the patient for possible focal reaction. Treatment was stopped when headache, dizziness, nausea, vomiting attributable to overexposure were complained of. All treatments were given in the forenoon, not too close to meal times.

Jesionek[11] believes that the pigment that develops in the skin under the effect of irradiation is carried by the blood to the diseased focus where it exerts a therapeutic action. Jessel[12] recommends the discontinuation of treatment in cases in which marked pigmentation develops until it decreases, on the assumption that the newly formed pigment prevents the penetration of the effective rays. It is our impression that pigmentation cannot be regarded as a guide to intrinsic therapeutic results. It is not a part of the healing process but only a by-product of irradiation. We have seen satisfactory improvement in patients who tanned well, as well as in those with slight tanning.

It is a mistake to exclude the skin surface over the chest when full exposure is reached, except in an unusually sensitive patient. The penetration of the radiant energy of the carbon arc lamp varies from a minimum of 0.1 mm. in the far ultraviolet portion of the spectrum to a maximum of 10 mm. in the region of the near infra-red; therefore, these rays cannot pene-

trate through the chest wall, and the lungs are not directly accessible for them. On the other hand, such an avoidance of exposure is illusory from the standpoint of protecting the lungs, because the light energy or its products are carried from any irradiated part of the body to these tissues.

Statistical Study

During the past three years 115 patients were treated with carbon arc irradiation at Muirdale Sanatorium. Of these 94 had pulmonary tuberculosis and 21 tuberculous pleurisy. There were 56 males and 59 females; 111 whites and 4 negroes. The inclusion of negroes into the treatment group seemed to be justified although one might expect a less satisfactory therapeutic response in them than in the whites on the basis of the observations of Macht and his associates,[15] who found that white human skin is more permeable to ultraviolet irradiation than negro skin owing to the presence of pigment in the latter. The curative effect of ultraviolet rays in rachitic negro children speaks in favor of the possible efficacy of light treatment in tuberculous negro patients.

The age distribution corresponds closely to that of the sanatorium population. There were 11 patients less than twenty years old, 54 between twenty and twenty-nine, 26 between thirty and thirty-nine, 16 between forty and forty-nine, and 8 over 50 years of age.

According to the classification of the National Tuberculosis Association, 8 patients had minimal, 61 moderately advanced, and 25 far advanced pulmonary tuberculosis. Twenty-three patients had fibrocaseous lesions, and twelve had cavities.

In 89 patients the chief consideration for the treatment was the tuberculous process of the lung or pleura, while in 26 patients the treatment was given primarily because of the presence of complications. All patients in the latter group had active pulmonary tuberculous, or a tuberculous pleurisy at the beginning of the treatment. The tuberculosis complications were: 7 cases of bone and joint tuberculosis; 2 of cervical adenitis, (1 with a discharging sinus); 3 of renal tuberculosis, (1 with a postoperative discharging sinus); 1 of ischiorectal fistula; 1 of ischiorectal fistula and laryngitis; 1 of tuberculosis verucosa cutis; 5 of pleurisy; 1 of pericarditis; 4 of peritonitis; 2 of laryngitis; 2 of intestinal tuberculosis; 2 of enteritis and laryngitis; 1 of enteritis, laryngitis and cervical adenitis; and 1 of epididymitis with sinus. Nontuberculous complications were: 1 of pyogenic osteomyelitis; 1 of silicosis; 2 of chronic hypertrophic arthritis; 3 of diabetes mellitus; 1 of colloid goiter; 1 of latent syphilis, and 1 of mitral regurgitation.

It may be of significance to mention that during the course of treatment 38 (33 per cent) patients had reactions that seemed attributable to the irradiation. These included 4 cases with headache, 1 headache and loss of weight, 1 headache and streaked sputum, 1 headache, nausea, vomiting and marked erythema, 1 headache, thoracic pain, dyspnea and marked erythema, 1 headache and gastric distress, 4 elevated temperature, 1 elevated temperature and loss of weight, 1 elevated temperature, increased cough and expectoration, 3 elevated pulse rate, 1 loss of weight, 1 general discomfort, 1 weakness, 1 nausea, 1 nausea and vomiting, 1 nausea and gastric distress, 1 gastric distress, 1 increased cough, 1 streaked sputum, 1 frank hemorrhage and marked erythema, 1 progressing pulmonary process, elevated temperature, abdominal pain and vomiting, 1 increased number of moist rales, elevated temperature and marked erythema, 1 sputum turned positive, 6 marked erythema, 1 marked erythema and generalized arthritic pain.

Of the 38 patients the reactions were of short duration and of minor

importance and did not necessitate the termination of the treatment in 25 (65 per cent). We wish to emphasize the relative infrequency of pulmonary hemorrhage. Too, serious focal reactions were not as frequent as one might have anticipated in moderately and far advanced cases. The latter group, however, showed reactions in 13 (52 per cent) as against the moderately advanced group with 17 (27 per cent). Of the 12 cavity cases 6 (50 per cent), and of the 23 fibrocaseous cases 11 (47 per cent) had reactions. These data suggest particular care in these types of the disease.

Out of the 61 moderately advanced cases, treatment was discontinued because of a reaction in 6 (9 per cent); this amounts to 35 per cent of those who had reactions in this group. Out of 25 far advanced cases the treatment was stopped following a reaction in 6 (24 per cent); this amounts to 46 per cent of those who had reactions in this group. Out of the 21 pleural cases only 1 (4 per cent) had a reaction because of which the treatment had to be discontinued.

As to the time of onset of these reactions, erythema appeared most often during the first and second weeks. Other manifestations were noted without any regularity, but, usually, after the fourth week of treatment.

Concerning the tolerance of patients over 50 years of age, out of a group of 8 patients, of whom 3 had far advanced and 5 moderately advanced lesions, and 2 had fibrocaseous type of tuberculosis, and 1 had a cavity, reactions were noted in 4 (50 per cent), but in none was the reaction serious enough to suggest the discontinuance of the treatment. We found that patients who had a markedly increased sedimentation rate of the red blood cells developed therapeutic reactions about twice as frequently as patients with only slight acceleration of the sedimentation rate. The occurrence of reactions was not more common amongst patients who had an intensive tuberculin skin reaction than in patients with small or moderate tuberculin allergy.

There were a number of patients who, when carbon arc lamp treatment was prescribed, offered resistance and manifested lack of cooperation. In some of these the treatment was discontinued at their request because of pseudoreactions. To illustrate this point, we wish to cite two cases who complained of recurring headaches, and refused further treatment. The headache was relieved by the extraction of a diseased tooth in one; in the other case the examination by a specialist revealed a nasal obstruction as the source of the headaches. One patient stopped taking the treatment because of streaked sputum and epistaxis. He had several similar incidents before and subsequently without light treatment. One patient attributed an acute upper respiratory catarrh to the irradiation. Another type of pseudoreaction was observed in a patient (A. T. No. 8556) one month after the treatment was begun. The temperature rose to 38.3 degrees C., and it returned to normal in three days, a week later she complained of weakness, lack of appetite, and abdominal pain. A subsequent gastrointestinal roentgen ray study revealed a tuberculous enteritis. No doubt the apparent reaction originated from the intestinal tuberculosis that coincidentally became active during the carbon arc lamp treatment. All but two of these patients were women. We wish to emphasize the necessity of thorough scrutiny and proper psychologic management of each case.

The treatment was discontinued in 17 because of lack of cooperation. Other reasons for discontinuing the treatment were: Termination of the treatment for all patients in the late Spring, 46; discharge as healed, 9; discharge as apparently arrested, 12; discharge as quiescent, 2; discharge against medical advice, 6; phrenic nerve operation, 3; artificial pneumothorax, 1; aspiration treatment of empyema, 1; pneumococcic lobar pneumonia, 1; reactions to light, 13 (11 per cent of all cases treated); reason not record-

ed, 4. The reactions for which the treatment was discontinued were: Erythema, 1; headache, 4; headache, marked erythema, nausea and vomiting, 1; elevated temperature and loss of weight, 1; loss of weight, 1; weakness, 1; increased cough, 1; progressing pulmonary process, 1; streaked sputum, 1, and frank pulmonary hemorrhage, 1.

The results were analyzed in a group of 38 patients whose treatment lasted from 3 to 6 months. There were 1 minimal, 18 moderately advanced, 12 far advanced pulmonary, and 7 pleurisy cases in this group. The only minimal case became apparently arrested. The moderately advanced cases were classified: 7 apparently arrested, 2 quiescent, 3 improved, 6 stationary; the 12 far advanced cases: 4 improved, 6 stationary, 1 worse, 1 died. All pleurisy cases were discharged as healed following the treatment.

Four pulmonary cases were discharged as apparently arrested and two pleurisy cases as healed among the patients in whom less than three month treatment was given. No attempt is made to attribute the "cure" to such a brief course of irradiation. Whether these patients would have reached the same stage of recovery during the same length of time is an open question. The purpose of the treatment was the consolidation of the healing process already in progress in these cases.

The evaluation of the effect of light treatment is rather difficult in the group of patients whose treatment lasted from 3 to 6 months for two reasons. First, because of the following coexistent complications in 20 (52 per cent) out of 38 patients; multiple bone tuberculosis, 1; bone tuberculosis with sinus, 2; Pott's disease, 1; Pott's disease and silicosis, 1; bone tuberculosis and tuberculous laryngitis, 1; renal tuberculosis, 2; renal tuberculosis and chronic otitis media, 1; tuberculous pericarditis, 1; pleurisy with effusion, 1; tuberculous peritonitis, 1; cervical adenitis with sinus, 1; ischiorectal fistula, 1; tuberculous epididymitis with sinus, 1; tuberculosis verucosa cutis, 1; colloid goiter, 1; chronic hypertrophic arthritis, 1; chronic pyogenic osteomyelitis, 1; diabetes mellitus, 1. Secondly, because some of these patients were treated simultaneously by local mechanical measures to the lungs. Thus, out of 31 pulmonary cases 7 (22 per cent) were given artificial pneumothorax, and 2 (6 per cent) phrenic nerve block. A modified Sauerbruch-Hermannsdorfer-Gerson diet was used in 3 patients, one of whom was getting also artificial pneumothorax. One important fact, however, seems to indicate the usefulness of light treatment; namely, none of the patients that reached the apparently arrested or the quiescent stage was receiving artificial pneumothorax or phrenic nerve block while on light treatment.

In a recent publication Coulter and Carter,[14] reporting on their results with carbon arc treatment in 30 cases of pulmonary tuberculosis, state that analysis of the literature on this subject since 1902 shows that of 70 competent observers 46 had favorable and 24 poor results or none at all with ultraviolet radiation in pulmonary tuberculosis. They conclude from their own experience that carbon arc irradiation in doses sufficient to produce a mild erythema and subsequent pigmentation had no beneficial effects in cases of active pulmonary tuberculosis. They found also that there was no suggestion that ultraviolet irradiation had any uniform effect on the red blood cell count, the hemoglobin value or the white blood cell picture.

Summary

1. Observations on 115 patients treated with carbon arc irradiation are presented. Ninety-four had pulmonary tuberculosis and 21 tuberculous pleurisy.

2. The spectrum of the light energy emitted from the carbon arc lamp is the closest approximation to natural sunlight. Biochemical, experimental and clinical studies, and empirical observations on the effect of light upon extrapulmonary forms of tuberculosis, although not unchallenged, offer a rational foundation for the use of carbon arc lamp in pulmonary tuberculosis.

3. The two main factors upon which the success or failure of this treatment hinges, are: First, careful selection of cases; secondly, proper technic.

4. It must be kept in mind that tuberculosis is a systemic disease, regardless of its location, therefore, the purpose of treatment should be an attempt not only for the acceleration of the healing process in the involved organ, but also for the increase of the general resistance and defense of the body.

5. Minimal, moderately advanced and even far advanced cases may benefit by this treatment, provided, the temperature is not over 37.5 degrees C., and the general physical condition is satisfactory. Patients with fibrosing or exudative lesions, including cavities, may respond favorably.

6. When deciding the problem of suitability for this treatment, the sedimentation test, the Arneth or Schilling count, the total leucocyte count, and the monocyte-lymphocyte ratio are of value. A high leucocyte count, marked "shift to the left" in the Arneth or Schilling count, and a greatly increased monocyte-lymphocyte ratio contraindicate irradiation.

7. Other contraindications are: Fever, rapidly advancing type of pulmonary tuberculosis, large cavities, acute stage of tuberculous pleurisy, poorly compensated heart lesion, marked general debility, and amyloidosis.

8. There are no other guides to the effectiveness of treatment than close clinical and laboratory observations in individual cases. The dosage by which the patient becomes sufficiently irradiated cannot be predetermined. The optimum exposure is the minimum exposure that elicits the desired therapeutic response.

9. Many failures are caused by prolonged overexposure. Overexposure is more likely to set up a reaction in the tuberculous lung, that might be accompanied by a perifocal inflammation, tissue destruction and constitutional symptoms, than in any other form of localized tuberculosis. The explanation of this fact lies in the immense vascularity of this organ.

10. Reactions, in general, are more likely to occur in cases with far advanced or exudative lesions than in other types.

11. Minor reactions that did not necessitate the discontinuance of the treatment occurred in 25 (21 per cent) cases. The treatment was stopped because of reactions in 13 (11 per cent) cases.

12. The variable course of pulmonary tuberculosis, under any regime, calls for a close analysis of reaction-like incidents during carbon arc lamp treatment. Some of the reactions, as seen in our cases, might have occurred as mere coincidences.

13. Considering the rather extensive degree of tuberculosis of our patients, serious focal reactions and spread of the disease were relatively few.

14. Pulmonary hemorrhage was not more frequent during treatment than we are accustomed to see it in the same type of tuberculosis without irradiation.

15. Some of our patients attributed certain symptoms to the irradiation that, we found, had nothing to do with the treatment; still they requested the discontinuance of the irradiation. Such an attitude can be explained by the mental make-up of the patients. These so-called pseudoreactions were not uncommon, particularly amongst women.

16. Analysis of the end results in a group of 38 patients whose treat-

ment lasted from 3 to 6 months shows the following results. One minimal case became apparently arrested; of the 18 moderately advanced cases, 7 became apparently arrested, 2 quiescent, 3 improved, and 6 remained stationary; of the 12 far advanced cases 4 improved, 6 remained stationary, 1 became worse, and 1 died. All patients with tuberculous pleurisy made a complete recovery.

17. Although no control group was observed during the same period, these results compare favorably with those found in sanatorium patients of the same classification groups who were discharged from Muirdale from 1933 to 1935.

Conclusion

Carbon arc treatment in a selected group of sanatorium patients, with general exposures not exceeding 30 minutes per day, produced satisfactory therapeutic results that justify the further application of this treatment in pulmonary tuberculosis and in tuberculous pleurisy.

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DIATHERMY IN BILIARY TRACT DISEASE *

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It is a well known fact that between 40 and 50 per cent of gastrointestinal symptoms are due to biliary tract disease. As a rule, in patients with cholelithiasis the diagnosis is readily made and the indications for proper treatment are evident. However, in patients with non-calculous cholecystitis, which comprises the largest number of individuals with gall tract affections who seek medical advice, the diagnosis and indications for treatment are not always so clearly defined.

Cholecystectomy as well as non-surgical measures have been advocated for the treatment of disease of the biliary tract. The surgical aspect of this problem is beyond the scope of this paper. Of the numerous forms of medical treatment the most popular are the various types of Spa treatments, such as can be obtained at places like Carlsbad, Vichy or Saratoga Springs. The beneficial effects of the Spa treatments in biliary tract disease, aside from mental relaxation, are thought to be due mainly, to a superficial hyperemia produced by a warm bath or mud pack and the peristaltic, laxative and cholagogue action of alkaline waters containing chiefly sulphates or carbonates. Similar and perhaps quicker and more direct results can in my opinion be obtained by the application of diathermy over the gallbladder and liver regions in conjunction with the oral administration or duodenal instillation of various medicaments.

The introduction of solutions into the duodenum to produce an increased flow of bile, known as non-surgical biliary drainage, was first advocated by Lyon[1] as a diagnostic procedure. Shortly after this method was employed for its therapeutic value. A difference of opinion, however, soon arose and still exists as to the efficacy of this method, both from diagnostic and therapeutic standpoints, with clinicians about equally divided.

Diathermy has been used more or less empirically in abdominal diseases. However, thanks to the members of this Congress the therapeutic application not only of this energy but of all forms of physical therapy have been placed on a scientific basis.

During the past five years it has been my experience that when patients with biliary tract disease were treated by diathermy alone or in conjunction with the oral administration or duodenal instillation of various medicaments, better clinical results were obtained than when these patients were treated by other medical methods. The best results were seen to follow the combined method of diathermy over the gallbladder and liver regions and non-surgical biliary drainage. It was therefore thought of interest to evaluate the effect of this combined treatment in a series of patients with biliary tract disease who could be observed for at least one year.

Before attempting to treat a patient with this type of disease by non-surgical methods, it is first necessary to ascertain the following: Is the patient likely to be amenable to non-surgical treatment? Is the gall tract affection the sole or only an associated etiologic factor in the clinical syndrome? Are calculi present and if so, does the patient constitute a good surgical risk? To obtain these data, a careful history and thorough physical examination, including cholecystography and a gastrointestinal x-ray series

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are essential. Examination of the bile, blood, feces and urine are likewise indispensable.

The following case illustrates how important a thorough physical examination is, even in the presence of a typical history. Recently a patient was seen by me, who had a clinical syndrome due to a chronic cholecystitis. Cholecystography revealed an atonic gallbladder. The patient looked icteric and complained of a diarrhea of two years duration. A routine rectal examination disclosed a carcinoma of the rectum which was not visualized by a barium clysma.

The two laboratory procedures which should be stressed in discussing biliary tract disease are cholecystography and the examination of the bile and duodenal contents. Cholecystography has aided us materially in detecting the presence of biliary calculi, the patency of the cystic duct, and in establishing the diagnosis of non-calculous cholecystitis. The presence, absence or faintness of the gallbladder shadow or changes in its contour as well as a delay in emptying, are all guides in determining the presence of biliary tract disease, and the type of treatment which is indicated. For cholecystography I prefer the method of Stewart and Illick.[2]

The macroscopic and microscopic examination of the bile and duodenal contents as well as the color sequence after the duodenal instillation of various solutions likewise aid us in detecting the presence of calculous or non-calculous cholecystitis and the recurrence of calculi causing postoperative sequelae. The various types of crystalline elements observed in the bile and duodenal contents and their diagnostic significance in biliary tract disease, have been discussed in a previous paper.[3] The macroscopic and microscopic examination of the bile will often determine whether medical treatment should be tried or surgery advocated.

In patients with cholelithiasis the indications for surgery are, as a rule, definite. But in these patients, for example with cardiovascular disease, the question of surgery must be carefully weighed. In patients with non-calculous cholecystitis, medical treatment is usually advocated. If, however, after a course of medical treatment the attacks of colic continue, surgery should be advised. On the other hand in patients with abdominal symptoms without severe pain, medical treatment should be given a very intensive trial before surgery is recommended. For, as Graham and Mackay[4] have observed, patients with non-calculous cholecystitis with symptoms other than severe abdominal pain are less likely to be relieved by cholecystectomy.

Rehfuss and Nelson[5] are of the opinion that every gallbladder patient is a medical case, whether he submits to surgery or not. The surgeon, these authors state, can eliminate the end results of gallbladder disease, but he does not eliminate the factors which induce it.

In treating patients with postoperative sequelae, it might be of interest to add, the glucose tolerance test has also aided us in deciding the type of treatment these patients should receive. This aspect will be discussed more fully in a future publication.[6] However, I will state that in patients with recurring biliary colic and a continued upward trend of the glucose curve, exploratory laparotomy is indicated if a course of medical treatment does not give the desired results.

Clinical Study

As stated before in order to evaluate the clinical results of treating a series of patients with biliary tract disease by the use of diathermy and non-surgical biliary drainage, one hundred patients with non-calculous cholecystitis and twenty-five patients with post cholecystectomy sequelae were studied. The ages of the patients in this series varied from twenty to sixty-

eight years. Eighty-nine (71.2 per cent) were females and thirty-six (26.8 per cent) were males. While patients with cholelithiasis, catarrhal jaundice and hepatitis without evidence of cholecystitis were also treated by this method, they were not included in this series. Patients with cholelithiasis were so treated only when they refused operation or when some contraindication for surgery existed.

The patients under study were observed for at least one year, because it was felt that any non-surgical form of treatment should result in the patients being comfortably relieved of their symptoms for at least that time. Furthermore, yearly courses of treatment should be instituted in an attempt to overcome the underlying metabolic dysfunctions which are the probable predisposing factors in biliary infection and stasis. That this fact is recognized by the layman is shown by his yearly pilgrimage to the Spa, until he remains comparatively symptom free for a long period.

Of the one hundred patients with non-calculous cholecystitis 68 per cent remained symptom free or comfortably relieved of their complaints for at least one or more years. In 32 per cent there was either no material improvement or a recurrence within this time. Twelve of these thirty-two patients (37.5 per cent) were operated upon. Attacks of biliary colic were the chief complaint in nine of the patients who came to surgery. Of the twenty-five patients with post cholecystectomy sequelae who were observed, fourteen (56 per cent) have remained comparatively symptom free for at least one year, and eleven (44 per cent) showed either little or no improvement or had recurrence of symptoms within this period of time. Surgery was advised in eight (72.7 per cent) of these eleven patients.

The chief complaints of the 125 patients who comprise this series were the following: Attacks of biliary colic, nausea and vomiting, gaseous eructation, heartburn, constipation or at times diarrhea, abdominal distention or distress after eating, and migraine.

Spastic colitis was very frequently observed. Achlorhydria or hypochlorhydria was also found quite often, although hyperchlorhydria and peptic ulcer were by no means rare. Arthritis was also frequently encountered. In patients past fifty years of age, cardiovascular disease, especially coronary thrombosis, was commonly found.

The following case reports will illustrate some of the varied clinical manifestations which were observed:

Case Reports

Case 1. — Illustrates the effect of the treatment upon a patient with a history of biliary colic and with positive cholecystographic and biliary findings. Mr. J. K., 43 years old, gave a history of having had attacks of sharp pain in the upper right quadrant on and off for two years. Physical examination revealed tenderness over the right upper quadrant. Cholecystography showed no gallbladder shadow and upon repetition one month later a very faint shadow was seen. A slight color response was obtained after the instillation of a 25 per cent solution of magnesium sulphate. Bile microscopy showed a few cholesterol crystals and a slight amount of calcium bilirubinate pigment. The patient was given a course of treatments and remained symptom free for three years. Six months after the completion of the treatment cholecystography revealed a good functioning gallbladder and non-surgical biliary drainage showed "B" bile. No crystalline elements were seen.

Case 2. — Illustrates the effect of the treatment on a patient with an atonic gallbladder. Mrs. M. C., 39 years old, gave a history of attacks of severe abdominal pain radiating to her shoulders on and off for five years. Physical examination revealed marked tenderness over the liver and gallbladder regions. A fair color response was obtained by non-surgical biliary drainage. Cholecystography visualized a normal ballbladder shadow which did not empty after a fatty meal. Bile microscopy revealed many epithelial and pus cells and a few cholesterol crystals. The patient was treated eighteen months ago and has remained symptom free since that time, aside from an occasional feeling of distress after eating. One year after the

treatment the patient showed marked improvement in the gallbladder function and in the bile color response.

CASE 3. — Illustrates the painless type of biliary tract disease. Mrs. A. S., 41 years old, complained of attacks of nausea and vomiting on and off for two and a half years. The patient had a distinct icteric appearance although the index was only 9. There was tenderness over the gallbladder region. Cholecystography revealed a somewhat faint shadow of the gallbladder which functioned very well. Bile microscopy revealed a slight amount of calcium bilirubinate pigment. The patient was given a course of treatment two years ago and periodic treatments ever since. She had only one slight attack fourteen months after the first course of treatment. Otherwise she has been free from any gastric complaints. Cholecystography twelve months after the completion of the treatment showed a marked improvement in the gallbladder shadow.

CASE 4. — Illustrates the migraine aspect of biliary tract disease. Mr. A. V., 56 years old, gave a history of constipation, gaseous eruction, heartburn and attacks of migraine of ten years duration, the last named symptom being the patient's chief complaint. The patient had an icteric appearance although the index was only 8.5. Physical examination was essentially negative. Cholecystography revealed a large atonic gallbladder which contracted only slightly after a fatty meal. A slight color response was seen. Bile microscopy showed epithelial and pus cells; no crystals were seen. At one time a diagnosis of Menière's disease was made and at another time a cerebral tumor was suspected. The patient was given a course of treatment fifteen months ago and periodic treatments since then. He has had only one slight attack of migraine since the completion of his first course of treatment, although he must still take laxatives for constipation. Cholecystography and non-surgical biliary drainage likewise showed marked improvement.

CASE 5. — Illustrates the effect of the treatment in a patient with abdominal symptoms after cholecystectomy. Mrs. M. M., 51 years old, gave a history of having had a cholecystectomy three years ago. Since that time she has had attacks of dull pain in the upper right quadrant accompanied by nausea, vomiting and constipation. Physical examination revealed tenderness in the upper right quadrant. Bile microscopy revealed a few cholesterol crystals. The patient received a course of treatment twelve months ago. Since the completion of the treatments she has been comparatively free from any abdominal complaints.

CASE 6. — While this case was not included in the series, it is reported to show the effect of the treatment in a patient with probable cholelithiasis, in whom surgery was contraindicated at the time. Mrs. R. A., 51 years old, had attacks of severe biliary colic on and off for seven years. Physical examination revealed marked tenderness over the gallbladder region. Cholecystography repeatedly revealed no gallbladder shadow. Non-surgical biliary drainage did not show any "B" bile. Bile microscopy showed many cholesterol crystals and calcium bilirubinate pigment in the same particle. A diagnosis of cholelithiasis was made and operation advised. The patient refused although the attacks were severe enough, at times to require the use of morphin. About eighteen months ago she was taken ill with cardiac decompensation. After being confined to bed for one month, the patient improved and then had another attack of biliary colic. However, as she was not in physical condition to undergo an operation at that time, medical treatment was instituted. It is now fourteen months since the patient completed her first course of treatment with diathermy and non-surgical biliary drainage, with periodic treatments given since that time. She was also kept on a maintenance dose of digitalis during this period. She has had no attack of biliary colic for the past fourteen months. She is in good physical condition at present and therefore surgery was advised.*

Method of Treatment

The non-surgical method of procedure employed in the patients under study was as follows: A duodenal tube was inserted in the morning while the patient was fasting. When the bead entered the duodenum, conventional diathermy was applied over the liver and gallbladder regions, the smaller electrode being placed anteriorly and the larger one posteriorly. A range of 300 to 1000 milliamperes was used, until the patient felt a sense of warmth. Diathermy was given on the average of about 35 minutes, followed by the instillation of two ounces of a 25 per cent solution of warm magnesium sulphate into the tube. The bile was collected from the time the tube reached

* Note: This patient has since been operated upon for cholelithiasis and made an uneventful recovery.

the duodenum until after the completion of the treatment which took about one to two hours. Short wave diathermy was not employed because a metallic bead was attached to the duodenal tube.

The treatment was given two to three times weekly for about twelve treatments and at periodic intervals thereafter, as indicated. Not infrequently duodenal alimentation supplemented the treatment. Colonic irrigations, whenever needed, were employed.

Whenever diathermy and non-surgical biliary drainage are given before surgical intervention, it is essential that the patients should receive large quantities of fluids before operation because the above treatment results, to a certain extent, in dehydration. In patients suffering from diarrhea and loss of weight, 5 per cent peptone or 25 per cent glucose was substituted for magnesium sulphate.

Diathermy has not been of material benefit, in my experience, during an acute attack of biliary colic. In fact, the pain is aggravated. The use of diathermy should be limited to the interval stage. The application of diathermy in conjunction with non-surgical biliary drainage was not employed in patients who were debilitated or who had gastric hemorrhages.

Associated affections which are frequently encountered in biliary tract disease, such as spastic colitis, arthritis, cardiovascular disease, achlorhydria, hyperchlorhydria, peptic ulcer, anemia and endocrine disturbances must also be treated. In fact, the management of these associated diseases often continues long after the treatment of the gall tract affection.

The dietetic régime prescribed for the patients in this series was similar to that employed in any non-surgical management of biliary tract disease. In this connection it might be advisable to state that during an acute exacerbation of a gall tract affection a fat free diet is advocated. But during the intervals fats are permissible. Some observers advise special diets in an attempt to reduce the cholesteremia. Personally, I have not observed that hypercholesteremia is a frequent finding in gall tract disease. If, however, a definite increase in the blood cholesterol is present, exceeding 250 milligrams in 100 cubic centimeters of blood, a low cholesterol diet is advisable.

The general dietetic régime which I advocate in patients with biliary tract disease is similar to that employed in the ambulatory treatment of peptic ulcer. This consists of a liberal and high caloric bland diet, in which the patient eats, frequently, small meals. Raw fruits, raw vegetables, cold drinks, spiced or highly seasoned food are omitted. Eating late at night is avoided.

Discussion

A series of patients with chronic non-calculus cholecystitis and post cholecystectomy sequelae were treated by diathermy over the gallbladder and liver regions and the duodenal instillation of various medicaments, especially magnesium sulphate. Good results followed this method of therapy. In appraising the value of any non-surgical method of treatment for biliary tract disease, it is understood that the cases for medical treatment must be properly selected and that allowance must also be made that, as in peptic ulcer, spontaneous remissions do occur.

The use of diathermy, as is well known, results in the production of a surface hyperemia, as well as deep heat. Hence, by applying diathermy over the gallbladder and liver, we are able to secure a visceral hyperemia in these organs. Goldgruber[7] stated that when diathermy was applied over the liver, the bile obtained through a duodenal tube was darker and more profuse than was present before the use of diathermy. These phenomena

were often seen by me. In fact, at times the bile and duodenal contents simulated, macroscopically, the dark color of bile which is often seen after the intraduodenal instillation of magnesium sulphate. This observation interested me to such an extent that I made a comparative study of the gallbladder shadow and the macroscopic appearance of the bile and duodenal contents. Ten patients were studied and the cholecystograms and bile specimens were secured 40 hours after the ingestion of the dye, 15 to 45 minutes after the application of diathermy and 15 to 60 minutes after the duodenal instillation of magnesium sulphate. In eight patients, the gallbladder shadow was the smallest (fig. 1*C*) and the bile the darkest after the mag-

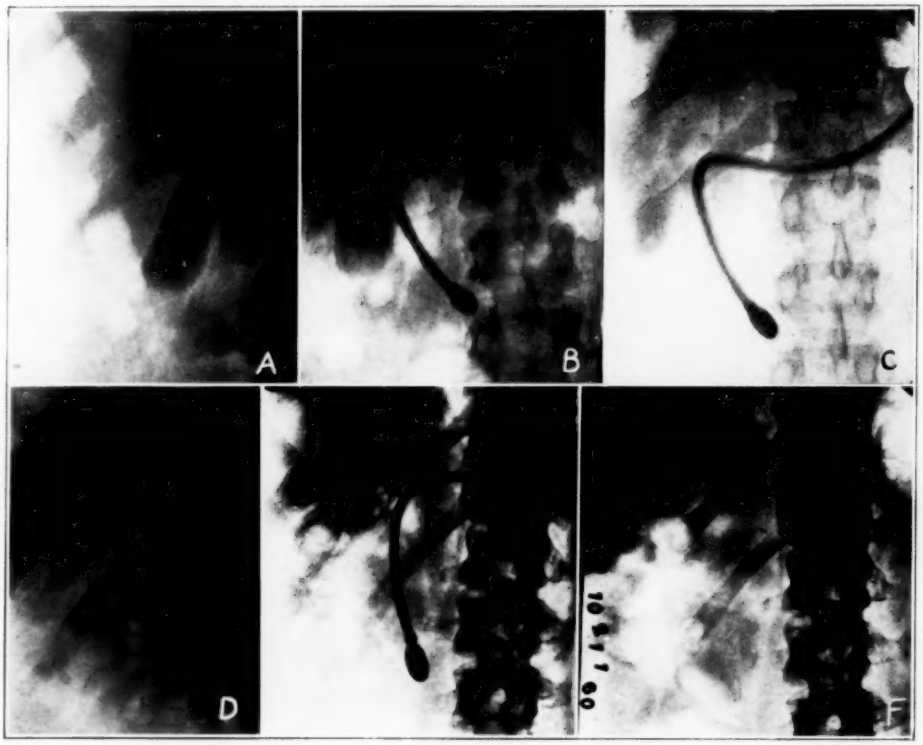

Fig. 1. — *A*, Cholecystogram forty hours after the oral administration of tetraiodophenolphthalein. *B*, Cholecystogram thirty-five minutes after application of diathermy over liver and gallbladder regions. *C*, Cholecystogram thirty minutes after duodenal instillation of magnesium sulphate. *D*, Cholecystogram forty hours after oral administration of tetraiodophenolphthalein. *E*, Cholecystogram after thirty-five minutes of diathermy over the liver and gallbladder regions. *F*, Cholecystogram sixty minutes after duodenal instillation of magnesium sulphate. Although one hour had elapsed after instillation of the magnesium sulphate, the color of the bile was still lighter than the bile obtained after application of the diathermy. Therefore this picture was taken at this time.

nesium sulphate. At times the gallbladder shadow was larger after the application of diathermy than that seen in the control film. In these patients there appeared to be much more contraction after the instillation of the magnesium sulphate, and the bile was much darker than when magnesium sulphate was inserted into the duodenum without a previous diathermy treatment.

In two of the ten patients the cholecystograms revealed evidence of contraction of the gallbladder shadow (fig. 1*E*), and the bile was very dark after the application of diathermy. When the magnesium sulphate was instilled into the duodenum of these patients, following the diathermy treatment, little or no further contraction of the gallbladder was seen (fig. 1*F*),

and the bile at this time was lighter than that obtained after the application of diathermy.

The action of the duodenal instillation of a solution of magnesium sulphate in causing a relaxation of the papilla of Vater with a resultant increased flow of bile has been thoroughly discussed in the literature. Whether this increased biliary output comes mainly from the gall-bladder or liver or both, has likewise been argued pro and contra for many years. The explanation of the effect of diathermy in causing changes in the color and flow of bile is still in the realm of theoretic speculation. Perhaps the action of diathermy, by producing local and visceral hyperemia, results in an increased secretory activity of the liver, with or without greater concentration of the bile in the gallbladder. Or diathermy, by producing a deep vasodilatation, may cause a relaxation of the papilla of Vater with a resultant emptying and contraction of the gallbladder. It is also possible that the visceral effects of diathermy may be due to reflex circulatory changes, secondary to superficial vasodilatation and hyperemia. Further studies will be necessary to fully explain some of the phenomena which have been observed when diathermy has been applied over the liver and gallbladder regions.

Diathermy and intraduodenal instillation of various medicaments in my opinion enable the physician to give patients a modified form af Spa treatment by a direct and quick method. In patients with biliary tract disease, the liver must be treated as well as the gallbladder. This fact was recognized by Waring[8] as far back as 1893. To obtain successful results it is also important that cognizance should be taken of the fact that associated affections must be treated as energetically as the gall tract disease.

The criteria by which we evaluate any form of non-surgical treatment are mainly clinical response, cholecystography, macroscopic and microscopic examination of the bile. Further treatment is indicated at the end of a year even if the patients remain symptom free, for the underlying hepatic dysfunction which predisposes to biliary stasis and infection needs more or less constant supervision.

Summary

1. A series of patients with non-calculous biliary tract disease were treated by a combined method — a modified form of Spa treatment — consisting of diathermy over the gallbladder and liver regions and non-surgical biliary drainage.

2. Good results were observed in most of the patients so treated.

3. Before attempting to treat patients with biliary tract disease by non-surgical methods certain facts must be ascertained. Methods have been outlined to obtain these data.

4. While patients with cholelithiasis are definitely surgical, any contraindication to operation justifies this combined treatment.

5. Better results are obtained in patients with biliary tract disease if the associated affections are likewise treated in addition to the gall tract disease.

6. A comparative study was made of the gallbladder shadow and the macroscopic appearance of the bile following the application of diathermy and the use of non-surgical biliary drainage.

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ELECTROPHORESIS IN PHYSICAL THERAPY *

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Introduction of drugs into the skin and through the skin into the body by the galvanic current has been used for more than a score of years. All this time there has been much discussion concerning the value of this type of therapy. Some, chiefly of the French school, claim to introduce kations and anions of inorganic and organic nature, and to localize their pathway in the body wherever they want the ions to act, the only restriction being given in non-conducting tissues like bones. Others, however, are skeptical concerning the efficiency of this method, because the amounts introduced into the skin are very small and rapidly carried away by the circulation of the rete malpighii without any possibility of a deeper penetration and localized action. During the last years, clinically, the usefulness of the electric introduction of vaso-active substances — histamine and choline compounds — has been amply proved. Therefore the entire problem of electrophoresis might be worth consideration or reconsideration by physical therapists.

We will discuss the following questions: (1) How does a galvanic current carry the substances into the skin and which of these are suitable for such an electric introduction? (2) How deep is the penetration by means of electric introduction, and how deep a therapeutic action can be expected? (3) As a conclusion from (1) and (2), we will, in a general way, outline the therapeutic possibility of electrophoresis and evaluate our own experience.

I have purposely avoided the application of the commonly used expression iontophoresis for our problem. Iontophoresis is the traveling of ions with an electric current to the pole of opposite charge in a solution of an electrolyte. The introduction of drugs into the skin by a galvanic current is frequently believed to depend entirely upon ionization and iontophoresis, and the skin is considered similar to an electrolyte solution. However, Rein[1] and others have, by electrophysiologic, chemical and histologic studies proved that the skin is not suitable for the performance of simple iontophoresis. The living part of the epithelial skin, the rete malpighii, acts electrically as a very complicated membrane with a negative electric charge. Water in contact with the skin will therefore, under the influence of a galvanic current, migrate through the pores of the membrane from the positive to the negative pole, the water taking up a positive charge when the membrane is negative. The water carries dissolved substances through the pores. This electrokinetic phenomenon is called electrosmosis. Rein showed that from two dye stuffs of similar ionization and molecular diameter, methyleneblue with a positive charge and introduced from the positive pole produced intensive and deep skin staining. However, eosin with a negative charge and applied from the negative pole produced a faint and superficial staining only. This result cannot be explained on the basis of simple iontophoresis, and shows how important is electrosmotic migration. An attempt to introduce a negative substance from the positive pole must fail, because neither iontophoretic nor electrosmotic transport can take place. It is not a mere

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technicality that electrosmosis plays a major role in the electric introduction of drugs into the skin. For the efficiency of iontophoresis, the highest possible concentration of the ions to be conducted is advantageous. Electrosmosis follows other laws. A high concentration of electrolytes diminishes its efficiency. A less concentrated and less ionized solution migrates more quickly than a strong ionized and concentrated one. Rein achieved, for instance, a much faster and more intensive anesthesia of longer duration by introducing a 2 per cent solution of cocain hydrochlorid in 80 per cent ethyl alcohol into the skin than by introducing a 30 per cent solution in water. Comparatively small amounts of electrolyte impurities play only a minor role in iontophoresis, but may almost abolish electrosmosis.

In iontophoresis the p_H of the electrolyte solution is important so far as it increases or decreases ionization. Its importance for electrosmosis is entirely different. The skin is a membrane with an iso-electric zone between p_H 3, 4. Normally, or covered with a solution with p_H above 4, it carries a negative charge, increasing with increasing p_H. The direction of electrosmosis goes then from the positive to the negative pole. Below p_H 3 the skin carries a faint positive charge, fluid in its pores therefore takes up a negative charge and migrates now from the negative to the positive pole. Rein was able to improve staining with eosin from the negative pole by applying it in n/500 HCl, which certainly diminishes the ionization of the dye.

We come to the conclusion that electrosmosis plays an important role in the electric introduction of drugs into the skin in addition to iontophoresis. It is most efficient with positive substances from the positive pole. Solutions should be neutral or weakly alkaline, alcoholic solutions eventually proving more advantageous than watery ones. Electrolyte impurities must be carefully avoided. If the negative pole has to be used with negative substances, the solution should be acid with a p_H less than 3. These are the physical rules applicable for electric migration in membranes and the skin. However, in the living skin conditions are still more complicated because chemical and physicochemical reactions like precipitations and adsorptions, diffusion and transportation along lymp- and blood routes, absorption by cells take place. These conditions we do not know in detail, and cannot control. They are responsible that heavy metals like silver are fixed in the very superficial epithelial layer of the skin, that methylene blue penetrates to the subcutaneous tissue, and strychnin or acetylcholine is easily absorbed into the circulation, producing systemic reactions.

Only the epithelial skin forms a membrane. In the loose connective tissue of the corium no electrosmosis is possible, and electric migration takes place exclusively as iontophoresis, if at all.

Depth of Electric Migration

This leads to the second question. How deep is electric migration? The question is important. Electrophoresis is a local treatment. Systemic effects are unwelcome by-effects only, of uncontrolled dose. However, we frequently wish to act not only locally upon the skin, but locally upon deeper tissues, blood vessels, nerves, muscles. There are adequate histologic investigations on animals after electrophoresis of heavy metals, proving a very superficial immigration only. These experiments do not allow general conclusions as most of these metals, like silver, lead or iron, are chemically fixed by tissue proteins. Rein introduced methylene-blue on dogs and rabbits and obtained with a 1 per cent solution in 80 per cent alcohol containing 1:50,000 epinephrin the following result: Stratum corneum deep blue, stratum malpighii dark blue. The stained hair follicles reach into the subcutaneous fat tissue. Byer, of my department, repeated these ex-

periments on rabbits, examining also the underlying muscle tissue. After electrophoresis of 1 hour's duration, he was able to confirm Rein's results as far as the skin and subcutaneous tissue are concerned, and obtained intensive staining of the muscle fascia and some staining of the superficial intramuscular connective tissue. However, on human skin, examined on biopsy material, the same procedure resulted only in staining of the epithelial skin, most intensive on hair follicles and coil glands, and penetration exclusively with the latter into the subcutaneous tissue. There was no demonstrable stain on the muscle fascia.

Very probably there is no deep direct migration in human skin by electrophoresis. Therefore, it is not worth while for us to discuss whether deep penetration on animal skin is caused by electric forces or by diffusion. Even so, the effect of drugs introduced into the skin is not necessarily restricted to the skin. For many years we have known of sensory reflex connections between the skin and deep tissues. In a review by Kuntz[2] it was recently pointed out again, how pain, produced for example in the diaphragm is, by means of the sympathetic and sensory nervous system, referred to the skin of the shoulder region and from there to the sensory centers. Interrupting these reflex connections in the skin by cocain blocks the perception of the diaphragmatic pain. Similarly, more or less localized reflex skin areas exist for almost all organs, and probably for muscles and bones as well. Bornstein[3] has shown how superficial heat produces an impairment of the sensory chronaxie of the skin, and how this effect is transferred by sympathetic nerves to underlying muscles, resulting in an impairment of the motoric chronaxie. Reflex connections between skin circulation generally and the circulation of the splanchnicus area, between skin and coronary circulation, skin and kidney circulation and diuresis are well known. Bettmann[4] found that histamine applied intradermally produces hyperemia of underlying muscles, or applied to the skin of the lumbar region, diuresis, and observed in Bright's disease acute renal hemorrhages after histamine treatment of the corresponding skin area. Deutsch[5] believes — though without experimental proof — that histamine also has some effect upon sensory reflex connections between skin and muscle.

We can therefore answer our second question in the following way: Effects upon deeper or internal tissues by electrophoretic introduction into the skin can only be expected from drugs controlling in one way or another the reflex connections between skin and deeper tissues. Otherwise the efficiency of electrophoresis is restricted to the skin itself. Systemic effects are undesired results of electrophoresis and should be avoided, if possible.

Electrophoresis of Drugs

Now we proceed to the third point of our discussion. Electrophoretic introduction of drugs into the skin (or into mucous membranes) allows the treatment of large areas of skin evenly and repeatedly, without noticeable trauma or pain — a result not to be obtained, for example, by intradermal injections. Penetration takes place at least through the rete malpighii as far as the corium, a result not obtained by the application of medicated ointments or solutions. These are the advantages in the treatment of skin conditions. If the drug, applied by electrophoresis, acts upon reflex connections between the skin and deep tissues, its effects with this type of application will be slower, of longer duration, and possibly weaker than by parenteral or even oral administration. Its action can be more or less aimed at and restricted to certain parts of the body and systemic results can be excluded. Electrophoresis is not suitable for systemic treatment. The amount of a drug introduced into the skin and carried into the circulation

cannot be estimated with accuracy. These are the advantages and failures of electrophoretic application of drugs. Since electrophoresis of vasodilators has been introduced into therapy this method has gained new interest. A comparison of the results of an intramuscular, an intradermal injection, and an electrophoretic application of histamin shows best the efficiency and the limitations of electrophoresis.

From a practical viewpoint, electrophoresis has its value in the treatment of superficial skin infections like ringworm and sycosis, with the application of a 1 per cent silver nitrate solution, from the positive pole, one-half ma. per sq. cm., 20 minutes. One treatment seems to be sufficient to abolish tenia cruris; however, this disease is apt to be cured by almost any application. Silver electrophoresis along the margin of erysipelas might counteract further migration; my personal experience is but slight and I can say only that it is worth trying if x-ray treatment is not available. The technic is given above. Zinc electrophoresis is used for mild coagulation of the mucous membrane of the nose in hay fever and asthma. I suppose the present enthusiasm will subside after a while. Histamine electrophoresis is used as a method of densensitization in allergic skin disease like urticaria as well as in allergic conditions like hay fever and bronchial asthma. The rationale is that histamin is one, if not the only chemical transmitter of allergic celi reactions. The results are very doubtful. The application of magnesium salts, calcium salts, iodides and salicylates for skin diseases is obsolete. Electrophoresis with cocain or its substitutes in pruritus or for surgical skin anesthesia is hardly superior to other, more convenient methods.

Electrophoresis of vaso-active substances, histamine and choline compounds has been amply used since ten years in the treatment of myalgia, arthritis, vascular spasm and peripheral vascular disease. The value of this therapy for relief of muscular pain and spasm, for increased absorption of muscular, periarticular and articular infiltrates and exudates, for the relief of vascular spasms and the development of compensatory circulation, for the healing of ulcers, is undeniable. However, it is not a panacea. In addition to the mentioned local effects, histamine may have a favorable desensitizing influence in active rheumatoid arthritis, which, however, is very difficult to evaluate. I do not see much advantage in using choline compounds instead of histamine. If histamine primarily acts upon the capillaries, vasodilatation spreads immediately to the arterioles with the result of active hyperemia. With electrophoretic application hyperemia is of long duration, skin temperatures remaining elevated for two to three hours. As dilatation of deep vessels is caused by reflex, I do not see much difference between histamin and choline electrophoresis as far as deep circulation is concerned. Electrophoresis of dionin or bee poison, recently used in Europe, is definitely less advisable than the application of histamine or choline. Their action probably depends upon a secondary formation of histamine.

Of doubtless value is the electrophoresis of anesthetics for the blocking of referred pain. I use a 1 per cent solution of nupercain in 70 to 80 per cent alcohol, containing 1:20,000 epinephrin, positive pole as the active one, one-half ma. per 1 sq. cm., 20 minutes duration. We obtain good results in cases of chronic spondylarthritis, with or without involvement of the hips, where rigid spasm of the erector trunci or the muscle groups around the hips produce pain, muscle tenderness, increased limitation of motion and sometimes hyperesthesia and hyperalgesia of the skin. Such cases frequently do not respond to the usual physical applications and histamin. They frequently lose pain and relax, when the skin covering the entire spastic area is anesthetized. Anesthesia lasts from one to three hours and this period of

relaxation should be used for very mild effleurage. A few treatments, applied daily, may abolish spasticity and pain for a long period of time and thereby improve mobility even where marked bony changes are present. However, some patients do not respond, and may not even develop a pronounced skin anesthesia — for unknown reasons — in my experience more in women than men. Root pain in chronic spondylarthritis is only relieved for short periods of time and does not show a permanent improvement.

Summary

Electric introduction of drugs into the skin is a complicated physical and biologic procedure, consisting of electrosmosis and iontophoresis in addition to chemical reactions, adsorption and diffusion in the tissues. It is most efficient if drugs can be introduced from the positive pole, in not too concentrated, pure watery or alcoholic solutions of neutral or weakly alkaline reaction. If the negative pole is used as the active one, the solution should be acid. Penetration in human skin does not go further than through the rete malpighii and along the hair follicles and coil glands. Therefore electrophoresis is an intradermal therapy. Deep effects are caused by reflex action between skin and internal organs, muscles and deep vessels, respectively. Advantages and limitations of electrophoresis are given in the possibility of covering large areas, in the slow, prolonged action, in localized action, even where deep reflex effects play the role, and in the lack of systemic effects (if correctly applied).

Electrophoresis must not be used for systemic effects. Certain valuable applications are enumerated. Most important are histamine choline compounds, and cocain substitutes which act upon deep tissues along reflex pathways.

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EFFECTS OF ACETYL BETA-METHYLCHOLINE IONTOPHORESIS IN ARTHRITIS *

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Iontophoresis has been employed by others in this country and reports of good results have been published by J. Kovács.[23] In Europe, iontophoresis as such has been used for the treatment of arthritis for some years. In the hands of certain investigators it is reported to have yielded gratifying results. Since, however, histamine hydrochloride and acetyl β-methylcholine have been placed beneath the electrodes, the results have proved more satisfactory. The literature on the subject has been adequately covered by Rutenbeck.[24-25]

History

As acetyl β-methylcholine is a drug new in its therapeutic use, it may be the history of its development, is of interest. It was discovered by Strecker[1-2] in 1849 as a constituent of swine bile. He carried out further investigations and in 1862 published its chemical constitution. For some years its physiologic importance was unrecognized until Reid Hunt[3-4-5] and his coworkers became interested in its ester, acetylcholine. They found it produced two types of reaction on nerve muscle preparation and *in vivo*. The first they classified as a muscarine-like action with evidence of parasympathetic stimulation and the second as a nicotine response. The first could be suppressed by administration of atropin.

Dale[6-7] and his coworkers later became interested in the choline derivatives and performed a number of important and fascinating investigations. From their work it is now known that acetylcholine is a normal constituent of the body and has a stimulating effect on the organs controlled by the parasympathetic nervous system.

The preparations of acetylcholine that were used by Dale also showed the same muscarine and nicotine effects on nerve muscle preparations and *in vivo*. In the past few years Major and Kline[8] have done extensive work of a chemical nature on the choline preparation and succeeded in purifying and synthesizing various products by their new methods. Simonart[9] has demonstrated that some of these products continue to show, *in vivo*, the dual reactions noted by Hunt, Dale and others. He was also able to prove that some exerted an almost unique muscarine reaction and others a nicotine-like response. Acetyl β-methylcholine is an excellent example of the former. His investigations have been corroborated and extended by Comroe and Starr.[10]

These reports quickly interested various investigators. Carefully done work on the effects of subcutaneous injection of acetyl β-methylcholine in man was reported by Starr, Elsom, Reisinger, and Richards,[11-12] and also by Osler Abbott.[13] It was observed that following injections there was a fall in blood pressure, and an increase in heart rate, salivation, sweating, flushing and also polyuria. Abbott has shown that it also caused secretion of gastric juice. It has also been used in the treatment of paralytic ileus with occasional success.

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* The expenses of the investigation were defrayed by a grant from Merck & Co.

Another reason for the present interest in acetylcholine and closely related compounds is the significance of this chemical in the transmission of nerve impulse. Elliott[14] in 1905 reasoning from this basis of the action of adrenalin stated his belief that adrenalin was the direct cause of certain smooth muscle responses. Howell[15-16] was the first to offer evidence pointing toward an intermediary agent acting between nerve impulse and muscle receptor organs. His published experimental results showed an increase of potassium in the heart perfusate, and he advanced the theory that vagus slowing of the heart was due to an increased concentration of potassium produced by the nerve impulse which acted directly upon the heart muscle receptor organs.

The present status of the ideas on humoral transmission of nerve impulse has been competently and clearly reviewed by Loewi[17] and by Cannon,[18] both of whom have investigated the problem in a masterly fashion. The former has been more interested in the parasympathetic system and the latter in the sympathetic. Since this paper deals only with the former subject, Loewi's investigations alone will be summarized. In 1921 he[19] placed two frogs' hearts in separate containers and filled them with Ringers' solution. The vagus nerve of one of them was kept intact; it was electrically stimulated and the usual diminution in heart rate followed. After a lapse of time, the fluid from this heart was transferred to the second. This heart began to beat at a slower rate. From this observation Loewi generalized that the stimulation of the vagus nerve of a nerve heart muscle preparation produced a substance which was an essential intermediary product between nerve impulse and the receiving organ. He was later able to show, and his work has been abundantly corroborated, that this substance was identical with acetylcholine. He also showed that if atropin is first added to the preparation the substance is still produced, but due to the atropin, there is no muscle response. If he treated the nerve heart preparation with eserin (physostigmin) before stimulation a greater amount of acetylcholine-like substance could be demonstrated in the perfusate. He furthermore determined that there was an esterase in the tissues which hydrolysed acetylcholine and that this action was prevented if eserin was added to the extract.

His work has been extended by a number of investigators, and it has been shown to be applicable to all the muscles innervated by the parasympathetic. Quite recently Dale[20] has presented observations which he believes prove that acetylcholine is also a product of a voluntary motor nerve impulse and that it is the activating agent in striated muscle response.

This sketch is, of necessity, very brief and the work of many investigators has not been mentioned. For further reference one should consult the papers named and also those of Alles[21] and the Cronian Lectures of Dale[22] whose original investigations have been so important and fruitful.

Methods

In this report, we shall present the results attained in the treatment of chronic forms of arthritis by means of iontophoretic administration of acetyl β-methylcholine. Our patients were, in large part, from the dispensary of the Johns Hopkins Hospital. As the investigation progressed, we included a fair number of higher financial status. It may be stated as a contrast to the idea so prevalent today that those of higher financial status were generally of higher intellectual caliber.

We have found that a gratifying number of our patients were improved, many of them to a degree that stimulated them to send their friends to the clinic for treatment. Furthermore, we have found that certain types of

arthritis respond better than others and have learned several factors that influence prognosis. These will be given in some detail below.

In another article[25] we have published data which are strongly suggestive that acetyl β-methylcholine, when administered by iontophoresis, penetrates the barrier of the skin and causes a reaction similar to that produced by stimulation of the parasympathetic nervous system.

Iontophoresis is a term used for the act of driving a negatively or positively charged molecule into the subcutaneous tissues by means of a galvanic or direct current of electricity.

The instrument used was a simple but effective one consisting of a 45 volt B battery, with rheostatic control, and an attached ammeter capable of measuring in milliamperes. The wire from the positive pole was divided so that two or more electrodes were available for treatment when necessary. The positive electrode consisted of a thin piece of block tin of sufficient length to surround the part to be treated. The negative electrode was covered by a wet pad of cotton, or wool (a Morse pad). Care was taken that no sharp metal touched the skin and also that both electrodes were snugly fitted, to prevent eschars. The materials to be electrolyzed, normal saline or 0.25 or 0.5 per cent acetyl β-methylcholine were applied to the skin by means of asbestos paper which had been soaked in the desired solution. The positive electrodes were kept in place by means of cotton bandages firmly bound around them.

The circuit was closed and the amperage was slowly raised to 20 or 30 milliamperes, depending upon the local sensation of the patient, and kept there for 20 minutes. Generally the patients experienced a mild prickling or trickling sensation until the current became stabilized.

Pathologic Changes

Our patients can be divided, with reasonable assurance of accuracy, into two main groups:

1. Infectious or rheumatoid arthritis.
2. Hypertrophic or metabolic arthritis.

The criteria for this division have previously been discussed by one of us[27] and, in brief, are as follows: Infectious arthritis is usually found in the earlier decades of adult life. In childhood it has long been known as Still's disease. Its onset is frequently acute although it may be insidious. It generally and at times rapidly becomes polyarticular and is characterized by fusiform joint swellings which are red, warm and tender. In the chronic stages, the joints are distorted, cool, bluish and tender. In the early stages, there is no x-ray evidence of joint involvement. It is quite possible that at this time a pannus-like inflammatory mass originating from the synovial membrane is destroying areas of cartilage and forming fibrous adhesions with the adjacent bones. As the disease progresses, the changes within the joint cause a hazy or flaky appearance on the x-ray film which may be associated with areas of punctate destruction. The base of the bones becomes more permeable due to the absorption of calcium. In the late stages bony deposits are laid down, which are frequently indistinguishable from those found in hypertrophic arthritis.

The metabolic type of the disease usually appears in later life, although this is by no means an unbroken rule. The onset is more apt to be insidious and in the early stage monarticular with less associated **rubor, calor** and **dolor** than in the other group. X-ray films taken at this stage may show nothing or any grade of bony deposit within the joint capsule, so that symptoms of short duration may be associated with bony deposits, the formation of which must have been going on for long periods. At times, continued dis-

tress may be associated with the presence of a few spicules. In this type of arthritis, x-ray changes are found at the articular line of cartilage and epiphysis and spicules of bone are seen at the insertion of tendons.

Clinical Observations

In tables 1 to 3 we have summarized the data pertaining to this study. They may be briefly described as follows:

Sex: There were 28 men and 55 women.

Age and Type of Arthritis: The ages of the patients varied from 14 to 81 years, which we have grouped by decades with the following tabulation:

TABLE 1. — *Types of Arthritis and Ages of Patients*

Ages of Patients	10-19	20-29	30-39	40-49	50-59	60-69	70-81	Total
Hypertrophic	1	1	1	10	11	16	7	47
Infectious	0	8	12	6	7	3	0	36
Total	1	9	13	16	18	19	7	83

There were 36 patients having the infectious and 47 the metabolic type of arthritis. It is obvious that the patients with metabolic arthritis tend to fall in the more advanced age groups and that the infectious type is seen in the earlier decades. The number of treatments varied within wide limits. Many of the unsuccessful results were doubtless due to the fact that the patients received insufficient iontophoresis. On the other hand, it should be noted that most of the unsuccessful cases received treatments, the number of which would have been adequate to relieve signs and symptoms to a significant degree in those patients who had been helped. Most of the patients were treated about 30 times. A number received 50, 60 or 70 treatments. This number was given to those in whom there was a constant but gradual improvement. It was particularly in these instances, that improvement continued after the patients ceased returning to the clinic or were placed under observation.

It was not always possible to treat all the patients as regularly as seemed desirable. We found that the most satisfactory improvement was obtained by giving 3 to 4 a week for the first month. At the end of this period the individuals who were going to respond showed some sustained improvement, and the frequency of treatment could then be reduced to once or twice a week.

We have treated twelve patients with saline alone; only one of them showed any real improvement. There was a significant improvement in the clinical condition in about 70 per cent of the remaining cases, when acetyl β-methylcholine was substituted for saline. None of the patients knew whether they were receiving control or test treatments.

These control cases also served not only to demonstrate that iontophoresis *per se* is not an effective treatment for arthritis, but that the systemic effects produced by acetyl β-methylcholine iontophoresis (which included a fall in blood pressure, an increase in pulse rate, variable changes in body temperature, increased persistalsis, diuresis, prolonged local sweating) were the result of the passage of the drug across the barrier of skin and into the subcutaneous tissues. The local effects of treatment were striking. When the treated joint was freed of its electrode, a marked hyperemia was found. This gave way to protracted sweating, often of several hours. Pain was frequently alleviated with a striking increase in mobility of the treated joints. After each of the first few treatments, pain usually returned, but in the cases susceptible of benefit the pain gradually decreased as the treatments were continued. Mobility in these cases be-

came noticebly increased and swelling also diminished, the treated member quite often assuming an almost normal appearance. In the unsuccessful cases, the height of palliative improvement was reached after four to five treatments and at times signs and symptoms returned to their control dimensions while more treatments were being given.

The results of treatments in the infectious and metabolic groups differed: of the former, 55.4 per cent were benefited or made symptom-free, of the latter, 78.7 per cent derived the same improvement. In table 2, these cases are classified as "Well" (signifying without symptoms), "Improved" and "Not Improved." Thirty per cent of the infectious group became symptom-free and 25 per cent were improved. In the hypertrophic group, 25.5 per cent were symptom-free and 53.2 were improved.

Further analyses of the results show (table 2) that when the cases are classified in relation to the duration of symptoms there is approximately the same percentage of cases with infectious and hypertrophic arthritis in each of the four groups classified according to length of disease. The majority, however, were found to have been suffering for more than two years.

TABLE 2. — *Clinical Studies in Hypertrophic Arthritis With Acetyl β-methylcholine*

Length of Symptoms in Years		MILD			MODERATE			SEVERE			TOTALS			
		Well	Impr.	No Impr.	Well	Impr.	No Impr.	Well	Impr.	No Impr.	Cases	Well	Impr.	No Impr.
0 to .5	No. of cases	2	3	1	0	3	1	1	0	0	11	3	6	2
.5 to 1	No. of cases	0	1	0	1	2	2	0	0	0	6	1	3	2
1 to 2	No. of cases	1	2	0	1	1	0	0	1	0	6	2	4	0
2 and up	No. of cases	3	2	5	3	6	1	0	4	0	24	6	12	6
	No.	6	8	6	5	12	4	1	5	0	47	12	25	10
TOTALS:	Per Cent	30	40	30	23.8	57.1	19	16.6	83.3	....	100	25.5	53.2	24.3

TABLE 3. — *Clinical Studies in Infectious Arthritis With Acetyl β-methylcholine*

Length of Symptoms in Years		MILD			MODERATE			SEVERE			TOTALS			
		Well	Impr.	No Impr.	Well	Impr.	No Impr.	Well	Impr.	No Impr.	Cases	Well	Impr.	No Impr.
0 to .5	No. of cases	0	0	1	1	0	0	2	0	3	7	3	....	4
.5 to 1	No. of cases	1	0	0	0	0	0	1	1	2	5	2	1	2
1 to 2	No. of cases	1	1	0	0	1	1	0	0	1	5	1	2	2
2 and up	No. of cases	1	2	0	4	2	2	0	2	6	19	5	6	8
	No.	3	3	1	5	3	3	3	3	12	36	11	9	16
TOTALS:	Per Cent	42.9	42.9	14.3	45.5	27.2	27.2	16.6	16.6	66.6	100	30.5	24.9	44.3

In tables 2 and 3, we have also divided the cases so that it is possible to determine the relationship between the severity of the disease and its response to treatment; also to note the relationship of the length of disease to these two factors. In the hypertrophic group 20 were classified as having mild, 21 as having moderate, and 6 as having severe stages of the disease, in contrast to the infectious group in which it was thought that 7 were mild, 17 moderate and 18 severe. It may also be noted that in the metabolic group, an increasing proportion of the more severe cases were improved whereas in the infectious group the more severe cases were proportionally less helped. As noted before, when long duration of infection was associated with severe involvement the chance of improvement became progressively less and less.

In the metabolic group the vast majority of the patients suffered from a smaller number of abnormal joints than those having infectious processes. In the former cases, the duration of the disease, in relation to improvement after treatment, was of no particular significance. In the patients with infectious arthritis, we found that if the disease had been active less than two years and was more or less localized, we could obtain satisfactory results.

In the patients with rheumatoid arthritis whose disease was localized and had been present for more than two years only 60 per cent or less were helped. Patients suffering from generalized arthritis of less than two years duration, and which was classified as mild or moderate, frequently reacted favorably. In those with severe generalized involvement of any duration and in those whose duration of infection was over two years, irrespective as to whether the process was mild, moderate or severe, good results were obtained in less than 50 per cent. These cases usually showed a temporary benefit with early reduction of swelling and pain; however, they generally relapsed. They were particularly susceptible to coryza, light trauma and change in weather.

Discussion

Although the number of patients treated has not been large (83) we feel that the majority of them have been observed over a sufficient length of time to render the results of the study significant. The patients had all been previously carefully studied and the majority had received other forms of treatment without avail. We treated no cases of the infectious type until all the usual methods of investigation for location and removal of foci had been carried out. Many of them had received, without avail, treatment designed to desensitize or immunize them. In broad outlines, we have noted that the patient with limited involvement does better than those with chronic generalized changes. In fact, we have had practically no success in treating the patients with chronic severe polyarticular infective joint changes, most of them having secured early palliative changes but without substantial progress. The majority of the patients with hypertrophic arthritis are benefited if the treatments are continued for a sufficiently long period, and it is our observation that they continue to improve after the termination of treatment.

It may be noted in table 2 that the majority of the patients with hypertrophic arthritis were classified as mild or moderate, while of those with the infectious type, the majority were in more severe stages of the disease. However, it should be remembered that the metabolic type of arthritis is seldom found to be as severe as the infectious, and this has undoubtedly influenced our classification.

It may be especially pointed out that 100 per cent of the patients with severe metabolic arthritis were improved while only 33 per cent of the severe infectious group were helped. It is not our belief that in a larger series of the former there would be a similar percentage of improvement, although it would probably be high and for the reason that these really crippled patients are more prone to accept the slow and gradual benefits and continue their treatments more assiduously. In the successfully treated patients, there is diminution to cessation of pain, increased mobility of the joint, decrease in periarticular swelling and increase in strength of the affected limb or extremity.

It is of interest to point out that patients with bursitis derive considerable relief from the treatment. We have not treated a sufficient number of patients with gonococcal arthritis to permit a statistically significant report. It may be noted, however, that none of our four cases was relieved of symptoms. We have not obtained any real improvement in three cases of spondylitis deformans (Marie Strumple type) and the majority with sacro-iliac disease have not been helped. When a number of joints have been treated in one patient, a result has been frequently obtained which is excellent in one or more localities and only mediocre in others. In two instances only, diseased, non-treated joints improved while the treated joints were showing the beneficial results of the treatments.

We have found that of the 34 patients who previously had been constipated, 73 per cent were able to have normal bowel movements without the aid of laxatives shortly after the institution of treatments. In the hypertrophic group, 79 per cent were able to stop taking laxatives and also concomitantly derived benefit from their iontophoresis. In the infectious group, constipation was relieved in 54 per cent, even though in this special group of cases only 46 per cent noted improvement in their joint conditions. It seems to us that in the former group the relief of constipation is not thus shown to be a necessary factor in the treatment of arthritis but that it is a concomitant result and a further indication of the general reaction of acetyl β-methylcholine iontophoresis.

Summary

1. A method of administering acetyl β-methylcholine by iontophoresis has been described.

2. Eighty-three arthritic patients were treated in this manner: (a) Fifty-seven per cent of those suffering from infectious arthritis were helped, some became symptom-free; (b) seventy-nine per cent of those suffering from metabolic forms of arthritis were helped, some became symptom-free; (c) the patients with severe chronic generalized infectious arthritis derived only temporary palliative benefit.

3. The beneficial mode of action of the drug is not understood, but it seems likely that by its stimulating action on the muscles innervated by the parasympathetic system, it, in some way, increases the efficiency of the organism to readjust its metabolic processes. It does not seem reasonable that the improvement is the result of a purely local change.

4. Constipation was noted in 41 per cent of the patients. In the group of hypertrophic arthritis, where constipation was a factor, relief of both was obtained in 79 per cent. In the infectious group, 54 per cent of those constipated were relieved, but we have been unable to find any direct connection between the reestablishment of this function and the ultimate results as applied to arthritic signs and symptoms.

5. One of 12 patients who received saline iontophoresis derived definite benefit in that joint swelling and pain were decreased, and motility enhanced.

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(Concluded on page 237)

TREATMENT OF CANCER OF HEAD, FACE AND NECK *

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OMAHA

So many problems are involved in the treatment of malignancy of the head and neck that the therapy must always be fitted to the individual patient rather than the patient fitted to some particular type of therapy. In some patients either of several kinds of treatment may be effective, but there are many individuals in whom the results of a certain method of attack are far superior to any other. In one patient it may be x-ray, another radium, electrosurgery, classic surgery, and in still others, a combination of these methods.

In the ordinary epitheliomas high voltage x-ray has first place. In the extensive cases x-ray may be supplemented by electrocoagulation for residual resistant areas or for destruction of large infiltrated areas accompanied by pain or toxemia. In epitheliomas involving cartilage or bone, radiation alone is seldom sufficient, and must be supplemented by electrocoagulation followed by curettage. In our experience curettage is always necessary after coagulation, so that the physician may be assured that all of the tumor mass has been destroyed. Where curettage is not used with electrocoagulation it is impossible to know definitely whether the entire growth has been destroyed. In almost every case curetted after coagulation one can see small areas where the growth has dipped down deeper than was anticipated, and it is these small areas insufficiently treated, unless curettage is used, that later grow and produce the recurrences. Curettage enables the physician to see these areas, coagulate them, curette again and repeat the process until all evidence of growth has been removed.

Epitheliomas of the lip occur in two clinical types, the papillary and the invasive, the latter being much more resistant to treatment and more apt to extend through the lymphatics. Radiation is the method of choice combined with electrocoagulation and curettage in the invasive type. High voltage x-ray is preferable and should be applied over the lip and submaxillary and sublingual areas. Intensive treatment to vesication is necessary if permanent results are expected. Where glands are already involved interstitial radium should be combined with x-ray.

Where the cartilage of the ear is invaded in a small localized area, sharp knife surgery will give primary union and quicker recovery than electrocoagulation. On the other hand, there are many patients who present themselves with extensive cartilaginous involvement along the auditory canal. In this type of patient electrocoagulation has the advantage because the entire removal can be done without the loss of any blood and without the application of a single ligature. The coagulum separates from the margins of the wound in about seven days and rapid healing by granulation occurs followed by epidermization. The stump of the auditory canal remains open in most instances, and, if the middle ear has not been destroyed, the patient can still hear on the operated side.

The Nose, Sinuses and Mouth

Where the cartilage of the nose is invaded we prefer electrocoagulation followed by curettage. High voltage x-ray treatment is always used in

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combination with electrocoagulation, applied locally over the growth and over the draining lymhatic areas. Where extensive invasion of the lymphatic areas has occurred interstitial radium is combined with high voltage x-ray.

In cancers of the antrum (fig. 1, *A* and *B*) high voltage x-ray treatment is best. There should be no surgery because surgery results in infection, greatly reducing the chances for a good radiation effect. In some cases osteomyelitis of the maxilla follows attempted surgical removal of the growth from the antrum, which greatly debilitates a patient already below par and generally results in death. This is especially likely to follow surgery with inadequate removal of antral cancers which have eroded through the floor of the antrum into the mouth.

Cancers of the oral cavity without bone involvement can be treated best by high voltage x-ray. The advantage is the painless application, ability to adequately cover the involved area and draining lymphatic areas.

In patients with bone invasion from cancer of the mouth, electrocoagulation should be combined with high voltage x-ray. The diseased bone and adjacent soft tissue should be heavily coagulated, then curetted, the process being repeated until all evidence of cancer has been destroyed to healthy bone. This can be done with no bleeding and no ligatures. Warm normal salt irrigations every three hours keep the wound clean and carry away the coagulum. The soft tissue soon shows healthy red granulations and the coagulated bone gradually forms a sequestrum which can be removed when completely separated by the involucrum. In many cases the entire width of the mandible will come out in the form of a sequestrum but even when this does occur, there is no deformity of the face and the cavity soon closes with a firm fibrous scar. The remaining portion of the mandible preserves enough function so that the patient can masticate his food and thus gets along in surprisingly good shape.

Where the growth is on the upper jaw with invasion of the maxillary process or floor of the antrum the same technic can be followed. A permanent opening through the floor of the antrum may result but need not be feared. After complete healing has occurred a special artificial denture may be applied. Many patients prefer to plug the hole in the floor of the antrum with absorbent cotton. This cotton plug enables them to speak and eat naturally and can be removed frequently and a clean one inserted. The patients say this is a comfortable, simple and inexpensive method of caring for this type of defect.

In sarcomas or transitional cell epitheliomas of the tonsil, (fig. 2, *A* and *B*) high voltage x-ray is the therapy of choice. In adenocarcinoma of the mixed cell type in the tonsil which has not invaded through the capsule, surgical removal combined with high voltage x-ray is best. If invasion of the peritonsillar structures has occurred, x-ray without surgery should be employed covering not only the tonsil area but draining lymphatic areas as well.

In cancers of the pharynx, hypopharynx and larynx high voltage x-ray offers most with 23 per cent five year cures reported by Berven of the Radiumhemmet, Stockholm, and duplicated by others. Even in the extensive extrinsic cancers of the larynx palliation can be accomplished.

The Neck and Face

Extensive adenocarcinomas of the parotid gland are occasionally seen. They are very vascular and destroy the adjacent soft parts and even invade the mandible. Sharp knife removal is impossible and they are very radioresistant. Electrocoagulation offers the only hope. The tumor and all invaded tissue can be destroyed by coagulation and curettage, re-

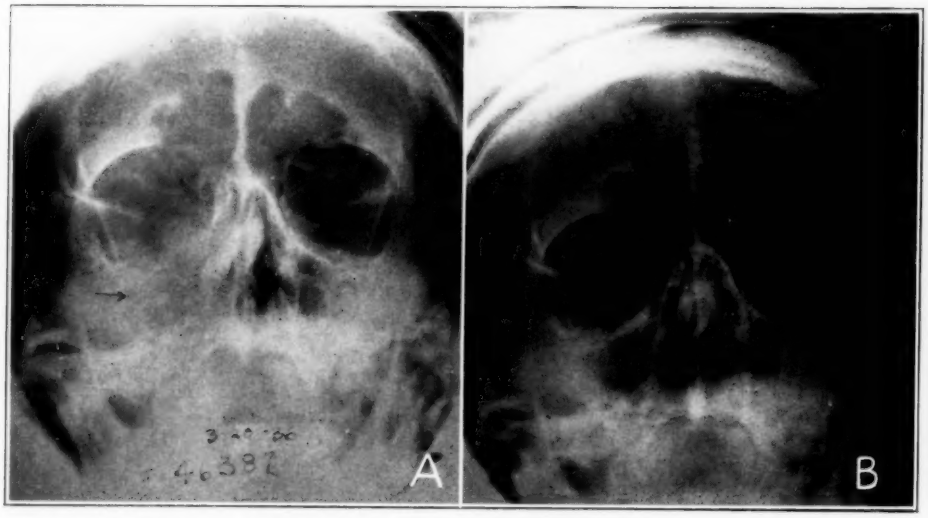

Fig. 1. — *A.* Cancer of the right antrum with erosion of the orbital floor and extension into the orbit producing exophthalmos, erosion of the nasal wall and blocking of the right nostril, erosion of the floor of the antrum depressing the right half of the palate. *B.* After fractional daily doses of high voltage x-ray using the Thoreus 2 filter, 4200 r units through one portal. 3100 r units added later. No demonstrable residue and the bone defects have filled in with scar bone.

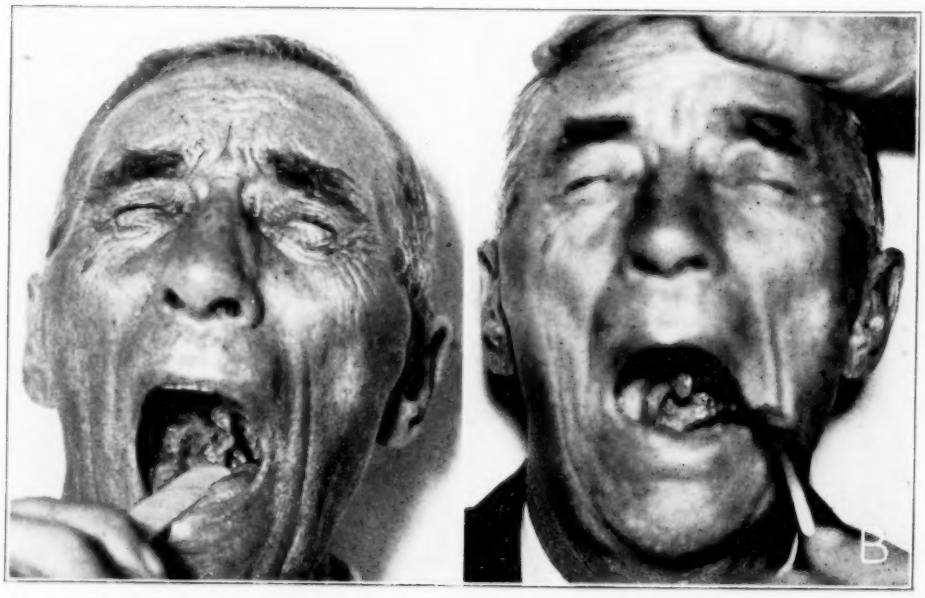

Fig. 2. — *A.* Sarcoma of right tonsil before treatment, the tumor filling the right pharynx and extending to the left of the midline pushing the uvula before it. *B.* Same patient with complete disappearance of the tumor following high voltage x-ray treatment by the fractional dose method.

peated until healthy tissue is encountered. It may be necessary to go through the mucous membrane of the mouth. Ligation of the carotid on the affected side is a good preliminary step though not always necessary.

Occasionally one is called upon to treat a very extensive tumor about the face, such as is shown in figure 3, *A* and *B*. Here electrocoagulation is the only possible method because fatal hemorrhage occurs with sharp knife surgery as soon as the subcutaneous vascular spaces are opened. By a special technic, using two active electrodes, the vascular spaces can be

Fig. 3. — *A*. Large degenerated neurofibroma arising from the right temporal region. The scar above the ulcer is from two previous attempts at removal by sharp knife surgery, stopped by hemorrhage as soon as the skin was incised. *B*. After healing had occurred following removal by electrocoagulation without any bleeding and without the application of a single ligature. The blood in the vascular spaces was coagulated before the spaces were opened.

coagulated before they are opened, thus making removal possible with no bleeding whatever and without the need for ligature.

Technic

Present results in high voltage x-ray therapy are in favor of filtration higher than 0.5 mm. copper in all but the purely localized small epitheliomas. The better results are due, in our opinion, to the ability to get greater dosage into the tumor without disastrous skin results. After all, the destruction of the tumor is the purpose toward which we strive. With 0.5 mm. copper filter the skin becomes badly irritated before the tumor has received a lethal dose. The skin reaction from this filter is slow to heal and usually leaves permanent telangiectases. On the other hand, where Thoreus 2 or 5 filter, as advocated by Merritt, is used, the skin effects are quite different, showing as an erythema followed by desquamation characteristics of the "epidermitis" of Coutard. The destruction of the skin is confined to the superficial layers and heals quickly leaving the skin soft and pliable.

Fractional daily treatments with the heavy filter giving 200 r. per day, as suggested by Coutard, continued until a strong erythema shows, then resting, is the only way to attain good results. We have followed this technic long enough to be convinced of the superior value of the heavy filter and fractional dosage. Slightly more time is required for each patient, but with the high milliampere output of modern machines, the time factor is greatly reduced and the improved results certainly justify the effort.

Electrocoagulation must be done with a spark gap type of high frequency machine of sufficient milliampere capacity to coagulate the most vascular tissue. Our usual technic is to have the indifferent electrode under the patient's bare back as he lies on the operating table on top of the pad. The active electrode should be made of aluminum with a rounded point. This type of electrode can be used to coagulate about the margin of the diseased area slowly, and all affected tissues and in this manner enucleating the area or it can be used against the surface.

In very vascular cases, such as shown in figure 3, *A* and *B*, two pointed aluminum electrodes are used holding one in each hand. They are pushed into the tissue parallel to each other about 2 cm. apart. In this way tremendous heat is generated in the tissue between the two electrodes. When the tissues assume a gray color and a soft uncharred condition, the electrodes are moved ahead and more tissue is coagulated. This process is repeated over the desired region, after which a little pull on the tumor separates it from its base, the line of cleavage following the coagulated strip. Where this technic is properly carried out, secondary hemorrhage is rare but it does occur and must always be guarded against.

This is a brief outline of the methods which we have found most helpful in producing palliation or cure in patients affected with malignancies of the head, face and neck.

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Mecholyl Iontophoresis In Arthritis

(Continued from page 232)

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SCIENCE, NEWS, COMMENTS

President Bierman Decorated

The members of the Congress and readers of the ARCHIVES will be pleased to learn that the President of the American Congress of Physical Therapy, Dr. William Bierman, was decorated with the coveted French Legion of Honor, civil section, during the recent International Fever Conference held in New York. There is no doubt in the mind of anyone that Dr. Bierman has merited this official recognition because of years of scientific work in the field of medicine and of his unremitting labors in the organization of international workers in the cause of hyperpyrexia. We felicitate Dr. Bierman heartily on his distinction as a Chevalier Légion d'honneur.

William Schmidt Appointed Consultant on Education to Council

The Council on Physical Therapy of the American Medical Association has recently appointed Dr. William H. Schmidt, assistant professor of physical therapy, Jefferson Medical College, on the consulting committee on education, a subsidiary organization of the Council. We congratulate Dr. Schmidt on this well earned recognition.

Heinrich Wolf Official Delegate to International Congress on Short Wave Therapy

From July 12 to 17, 1937 official Vienna will be host to an international gathering for the study of short waves in medicine, biology and physics. This conference will be under the patronage of the President of the Republic of Austria. The honorary chairmen are Professor d'Arsonval, Senator Marconi, and Professor Zenneck, respectively of Paris, Rome and Munich. Dr. Heinrich Wolf of New York will be the official delegate of the American Congress of Physical Therapy. For further information please address Dr. Paul Liebesny, Vienna, IX, Alserstrasse 4, Algemeines Krankenhaus.

Meetings of Physical Therapy Organizations

In this permanent column will be published information about meetings, election of officers, etc., of physical therapy organizations. New data should be sent promptly to the office of the Secretary, 1100 Park Avenue, New York.

American Congress of Physical Therapy; Cincinnati, September 20th to 24th; Dr. Richard Kovács, 1100 Park Avenue, New York, Secretary.

New York Physical Therapy Society; meetings at the New York Academy of Medicine, on first Wednesdays from October to May; Dr. Madge C. L. McGuinness, 1211 Madison Avenue, New York, Secretary.

Kings County Medical Society, Physical Therapy Section; meetings at 1313 Bedford Avenue, Brooklyn, bi-monthly on second Thursdays; Dr. H. T. Zankel, 5 St. Paul's Place, Brooklyn, Secretary.

Medical Society of the State of New York, Session on Physical Therapy; Rochester, New York, May 26th; Dr. H. J. Harris, Westport, New York, Secretary.

Pennsylvania Physical Therapy Association; meetings at the Philadelphia County Medical Society Building, third Thursdays from September to June; Dr. Arno L. Zack, 216 East Broad Street, Bethlehem, Pa., Secretary.

New England Physical Therapy Society; meetings at Boston on second Wednesdays from October to June; Dr. William McFee, 41 Bay State Road, Boston, Mass., Secretary.

Pacific Physical Therapy Association; meetings at Los Angeles, fourth Wednesdays.

Western Section, American Congress of Physical Therapy, Los Angeles, June 17, 1937, W. W. Worster, M.D., Chairman, 205 South Mission Drive, San Gabriel, Calif.

Program New York State Medical Society Session on Physical Therapy

Wednesday, May 26, 1937 — 10 A. M.

Chamber of Commerce Building, Rochester, New York.

Chairman: MADGE C. L. MCGUINNESS, M.D., New York.

Secretary: HAROLD J. HARRIS, M.D., Westport, New York.

1. The Investigation of Apparatus by the Council on Physical Therapy.

Howard A. Carter, B.S. in M.E., Secretary Council on Physical Therapy, American Medical Association, Chicago.

2. General Aspects and New Applications of Electrophoresis in Physical Therapy.

Karl Harpuder, M.D., New York.

Discussion: Jacob Levy, M.D., Syracuse, New York.

3. Physical Therapy in Relation to Internal Medicine.

Jacob Gutman, M.D., Brooklyn, New York.

Discussion: Harold J. Harris, M.D., Westport, New York; Virginia Tannenbaum, M.D., Buffalo, New York.

(Concluded on page 244)

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

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EDITORIALS

IMPRESSIONS OF THE EASTERN SECTIONAL CONFERENCE

Seldom has a conference on physical medicine initiated its transactions under such an unusual handicap as that which confronted the Eastern sectional group of the American Congress of Physical Therapy in its recent joint session with the New York and Pennsylvania Physical Therapy, the Essex County Medical Societies, and their host, the Academy of Medicine of Northern New Jersey. Following as this did within less than two days of the much publicized international discussion on fever therapy at New York, it opened its session under the none too assured feeling as to the responsiveness of a profession whose interest, energy and time had already been well spent on the therapeutic problems of electropyrexia. The meeting gave promise to be at best but an anti-climax to a highly organized and well directed climax. It was therefore an unusual experience to have witnessed such an adverse and unpromising situation transformed from an afternoon of mechanized auditors and straggling yawners to an evening made up of a unified, crowded and highly attentive audience.

The evening session saw an auditorium filled to the back seats with individuals of foreign and American citizenship, warmly responsive and spirited under the tactful leadership of its chairman, or rather chairwoman, Madge McGuinness. All credit is due her for the preparatory labors of mobilizing the personnel of the program and its harmonious presentation. Her appreciation of the colorful environment and her awareness of unofficial visitors and guests from European and South American countries gave her the very opportunity to transform as it were a very formal background into a gracious, festive mood. As an example, one recalls her whimsical and witty introductions, at times subtly pointed or couched in ironic dispensation. She more often dealt in miniatures than in caricatures, and painted in broad and generous strokes rather than in sharp or vinegary delineations. Any

audience unresponsive to such tactful wooings would have been cold indeed. An index that she possessed diplomatic as well as special professional qualifications was her courteous invitation to two foreign guests of her own sex. Doctors Martha Brünner-Ornstein of Vienna and Elinor Russel of England were invited to share co-chairmanship of the evening with her which both accepted with appropriate responses. Our ears tingled pleasurably after hearing the impressions of our foreign guests about our progressive country, our erudite profession and our generous people. Would that a more intensive cultivation of this spirit to be fostered in the name of Medicine for the better understanding between distant lands and their people, and the greater appreciation of their humanitarian aims.

No doubt that the underlying impression carried back by the various delegates from the recent fever conference will also embody similar experiences favorable for an increasing communion between separate nations in which nationalism will for the time at least be submerged to the greater appreciation and benefits from a frank exchange of knowledge. Bierman, the *spiritus rector* of the above mentioned conference and the President of our Congress responded to the invitation to relate his immediate impressions by stating that he not only was sanguine that such an *entente cordiale* would be definitely developed but that its benefits would be more manifest in time, owing to the common understanding built on interchangeable ideas and opinions. Fever therapy may be the modern fulcrum to aid in the unity of science as the common bond of a polylinguistic people and reduce the chauvinism of competing nations. The picture ofour distinguished President and Secretary of the first international conference on fever therapy as he faced his attentive audience was that of an individual who had whipped his energy to the verge of exhaustion in order to bring the conference to a successful conclusion. Under the circumstances there was more pathos in his gesture than optimism in his words. France had honored him with the ribbon of the Legion of Honor which he modestly wore on the lapel of his reputation.

The madam chairman's (a pleasant paradox) known talent to control mass moods and its psychology was here illustrated by the change of tempo introduced as a guide to the succeeding speaker and as a relief from the more serious drift toward which the previous speaker had directed our thought. She painted a whimsical picture of a man who came far but was always near to those interested in our discipline; a man locked in his ivory tower and yet close enough to be heard, a purist who was stylistic but not pedantic; a man who loved his rhetoric so well that he even blue penciled the very manuscripts that were already blue penciled; a man so inseparable from the journal that he edits, that the mention of one is to recall the other — we speak of the editor of our ARCHIVES. In his defense against these attributes and his notoriety in the literary field, the editor stated that nowhere was it more manifest that the chairman exercised her imagination out of courtesy to his labors than in her description of his questionable talents. From the description he felt more like a polyhedral mechanism each virtue neutralizing the other into a more or less inoperable circle. As for the statement that he is so well known, here again he took issue with the madame because wherever he went he was confronted with the rare experience of being mistaken for one of three individuals. Indeed, he began to feel as though he enjoyed a triple personality. He has been mistaken for the brilliant Kovács, the scintillating and rollicking Titus and least of all as the personality who has devoted a life time of service to the comfort and well being of the individual called Kobak. In this unusual situation one can also derive a certain amount of comfort. One can acknowledge the flat-

tered greetings to works which Kovács has formulated and the speaker only emulated, and by the same vicarious impersonation accept the hearty greetings to the name Titus, when otherwise the same man might have frankly greeted the speaker with the chilled and distant effort of one paying back a debt to another who had the temerity to make use of his editorial privilege of blue penciling a thought or an expression that has sprung from the very heart of his victims pulsating intellect. As an animal of his environment it is comforting that he can merge at will into either of the above distinguished personalities, but the fly in the ointment is — who is who when as now we all are met together under one roof?

In answer to the editor's distressed query, the chair called on Dr. Titus to disclose his presence not so much as proof that the resemblance is more imaginary than actual, but to report in brief the experiences of the Latin-American Congress of Physical Therapy, which recently met in Guatamala as the guest of that Government. The extraordinary success of this conference was Titus' theme, which suggested the value of the continued activity of this branch organization of the Congress.

So far as concerns the success and the selection of the scientific program, comment at this time is unnecessary, since the majority will be published in future issues of the ARCHIVES. The above impressions have been submitted with the intention of adhering to an objective reflection of the colorful background that made the Eastern sectional conference one of the most successful in the history of the American Congress of Physical Therapy.

CANCER OF THE HEAD AND NECK

From time to time articles have appeared in this and other medical periodicals dealing with cancer and presenting those physical therapeutic procedures which have been found reasonably effective in its management. While it cannot be said that our present methods are the solution for the cancer problem, we can at least content ourselves in knowing that investigation continues and that efforts are being made to advance our present knowledge. In physical therapy certain weapons are available to combat the more accessible neoplasms. Without these weapons, our results would be nil. No one disputes the fact that failures are numerous, yet with all these we frequently encounter some good results.

One of the indefinite problems has been the lack of compatibility of physical measures. The desirability of combining electrosurgery and x-rays and radium, has always been recognized, but when and under what circumstances has never been adequately determined. Occasionally some information is made available by one who has had the fortunate experience of being familiar with all known procedures. Tyler[1] presents a clinical report of his work in cancer of the head, face and neck and emphasizes the importance of proper combining of methods. The advances in radiotherapy and in electrosurgery have rendered possible an improved technic in attempting to solve a very difficult problem. The fact that some successes are on record is a testimonial to progress. The limitations are, however, well known. In our desire to assist the cancer afflicted we can, at least, institute treatment affording some hope. Until such a time when science will enlighten us how more rationally to deal with the cancer scourge, we must rely on known physical procedures in those combinations that have proved most beneficial.

Reference

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FEVER THERAPY IN GONORRHEAL OPHTHALMIA

While modern prophylaxis has contributed largely to the control of gonorrheal ophthalmia, this disease is still dreaded in most quarters. Of its complications corneal ulcer is probably the most serious often leading to panophthalmitis and all of its consequences.

Most authors give a grave prognosis for gonorrheal ophthalmia. For this reason even radical procedures merit a fair trial, especially in the absence of favorable progress from routine measures. The results obtained by the use of fever therapy are often striking. Metz[1] reported successful results immediately following fever treatment in two severe cases of gonorrheal ophthalmia, in one of which corneal involvement was extensive. A temperature was maintained between 106 and 107 F. for several hours, and although improvement followed the first treatment, two additional ones were given for six hours each. All that finally remained was a superficial scar and a nebulous opacity at the site of the larger one.

Hasler, Jr., and Spekter[2] reported on the use of artificial fever in six patients having gonorrheal ophthalmia. In five, the organisms disappeared after one or two treatments. In the sixth, the gonococci disappeared one week following the second treatment. These authors believe that fever therapy, when carefully carried out, is distinctly beneficial in gonorrheal ophthalmia.

In connection with fever therapy of gonococcic infections in general, various facts have been called to our attention. It has been found difficult to cultivate the gonococcus in patients with fever. Aside from this the poor or retarded growth of the organism on artificial media at temperatures slightly above 100 degrees F. has been observed repeatedly. These facts have been responsible for the use of foreign protein therapy in gonococcic infections with encouraging but non-uniform results. In some of the more severe cases, malarial inoculation has been tried, but all these methods, aside from the drawbacks already mentioned, occasionally produce unfavorable reactions which render them unsuitable for general utilization.

In controlled fever therapy the oculist now has available a powerful remedy to combat gonorrheal disease involving the eyes. The method is relatively safe if properly carried out. Serious ill effects related to the treatment have not been observed. While considerable research in this field has already been done, increased interest on the part of ophthalmologists is necessary for the wider utilization of this method.

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MORE ABOUT SCIENTIFIC EXHIBITS AT SIXTEENTH ANNUAL SESSION

The value of scientific exhibits at medical conventions has been thoroughly recognized. Most of the larger medical organizations have for years emphasized this feature with the result that they are now a fixture, an important phase of instruction and scientific learning. To keep abreast of these developments, the Congress also has instituted scientific exhibits as an important part of its annual program.

There is no field where scientific displays can be developed better than in physical therapy and its allied branches. Aside from the awards offered, the inducement to physicians and scientific workers generally, should be

the appreciation of those who view the displays. Last year, in New York, the number of exhibits offered was larger than could be adequately accommodated, but at the Cincinnati session to be held in September, ample facilities are available for all who contemplate reservation of space.

The program committee urges members to work up scientific exhibits for the forthcoming meeting. Every means at the disposal of the Congress will be offered to help in this work. Your exhibit need not be strictly within the limitations of physical therapy so long as it is instructive and in a related field. Exhibits from institutions of learning, hospitals and research laboratories are especially invited. Reservations for space should be addressed to the chairman of the program committee or the executive secretary, American Congress of Physical Therapy, 30 North Michigan Avenue, Chicago.

Members of the Congress who do not plan to exhibit are asked to urge others to do so. Let us all cooperate in organizing a scientific exhibit which in itself will make it worth while to travel across the country to view. The time is short and prompt action is necessary. It is hoped that this notice will bring many responses in an early mail.

CINCINNATI SESSION IN SEPTEMBER

Many of you already know that elaborate plans are under way for the fall session to be held in Cincinnati, September 20 to 24. Never before has there been such unified, enthusiastic cooperation as the Cincinnati medical groups are offering. With the support of the local university, hospitals and medical bodies generally, the sixteenth annual convention should be an outstanding one from every possible point of view.

The program is now being organized and numerous changes from the plan followed in the past will be effected. These changes are to be made to conform with recent developments in the field and to render the material available more valuable from the standpoint of instruction. After all physical therapy is no longer orphaned from medical learning. There are hundreds of centers, however, where no teaching in this work is doing done. Many hospitals are still without physical therapy departments. The gospel must be spread and the results of scientific physical therapy properly and ethically exploited to the profession. The Congress performs this function and its mid-year and annual meetings serve a definite purpose. A week at an annual Congress session is a veritable postgraduate course in physical medicine. No other medical group offers such an intensive program in this special field.

While September is still some months away, the time is opportune to make future plans. Arrange to attend this gathering. Bring your colleagues, their technicians and assistants, hospital executives and others who desire to acquaint themselves with all the developments in the newer science.

Those who are certain they will attend should make their hotel reservations early. The Netherland Plaza, one of the finest hotels in the country will be the official headquarters and all meetings and exhibits are to be held there. Cincinnati invites you to spend an enjoyable and profitable week. Combine your vacation with a worth-while postgraduate course in physical therapy. Bring your families. They, too, will find Cincinnati interesting and most hospitable.

Science, News, Comments

(Continued from page 238)

4. Relief of Pain by Physical Measures. *Richard Kovács,* M.D., New York.

Discussion: Peter Irving, M.D., New York.

5. The Value of Physical Therapy in the Rehabilitation of Some Common Hand Conditions. *G. G. Martin,* M.D., Buffalo, New York.

Discussion: D. V. Needham, Syracuse, New York; Alfred Ulrich, M.D., Buffalo, New York.

Pacific Physical Therapy Association Meeting

The regular March meeting of the Pacific Physical Therapy Association was held March 24, 1937, at the Hollywood Hospital, at which time a program was presented as follows:

Symposium on Short Wave — Part I.

1. Physics of Short Wave, *Lester Cushman,* M.S., Prof. of Physics at S. C. J. C., Las Sierra, Calif.

2. Experimental Deep Heating Effect of Short Wave and Diathermy on the Human Subject, *Clarence Dail,* M.D., Loma Linda, Calif.

3. Short Wave Therapy in Oto-Laryngology, *Cleon W. Symonds,* M.D., Pasadena, Calif.

Physical Therapy Technicians

Thirteen hundred and two hospitals reported 2,382 physical therapists. The greatest number of physical therapists, 1,648, appears to be serving in general hospitals. Other types of hospitals reported as follows: Mental, 350; orthopedic, 167; tuberculosis, 62; children's, 41, and all other institutions, 114.

Under the heading of physical therapy there is a variety of technical help, some of whom are skilled in general procedures while others specialize in massage, hydrotherapy, electrical or other forms of therapeutics. Their registry, which is likewise on a voluntary basis is known as the American Registry of Physical Therapy Technicians, located at 30 North Michigan Avenue, Chicago. The registry is comparatively new. As of March 1, 1937, it had received 183 applications and had issued certificates to fifty-nine persons.

A program of standardization and classification has been successfully carried out by the cooperative effort of the Council on Physical Therapy and the Council on Medical Education and Hospitals. After inspection by the latter council a list of acceptable schools was recommended and was adopted by the House of Delegates at the Kansas City session. — (The list of approved schools may be found in our ARCHIVES of January, 1937.) J. A. M. A. **108**:1046 (March 27) 1937.

Charles Gustavus Morris

We announce with profound regret the demise of Dr. Morris, of Three Rivers, Michigan, at the early age of fifty-two. Dr. Morris was graduated from the Detroit Medical College (now Wayne University College of Medicine) in 1914, and after passing his examination for licensure engaged in private practice. While Dr. Morris was elected to membership in the Congress only a few years ago, he had for some time taken a deep interest in the scientific advances of physical therapy. By his premature death the Congress has lost an earnest coworker.

Orval James Cunningham

We chronicle with deep regret the passing of Dr. Cunningham, of East Cleveland, Ohio, at the age of fifty-seven. A graduate of the University of Chicago (Rush Medical College) of the class of 1904, he soon after engaged in the practice of medicine. For some time he taught surgical anesthesia in the Kansas University Medical School, and became a member of the Associated Anesthetists of the United States and Canada. His interest in physical therapy was even greater than in the subject he taught, as is evidenced by his long membership in the American Physical Therapy Association. When this organization merged with the Congress, Dr. Cunningham maintained his active membership in the Congress in which he became a valued and valuable member through his splendid enthusiasm for our discipline. The Congress mourns the loss of a fine colleague.

Edward Henry Trowbridge

We announce with regret the recent death of Dr. Trowbridge, of Worcester, Massachusetts, at the age of eighty-one. He was a graduate from Bowdoin Medical School (Maine) in the year 1884. As Massachusetts had no license law or examining body, he followed the custom of the time and assumed practice in which he early manifested a special interest for gynecology. He continued to practice in this specialty to his death. Dr. Trowbridge was an active member of the Congress up to two years ago. He will be remembered by all who attended the surgical section of the meeting held in Philadelphia as an enthusiastic participant in its deliberations. He was connected with several hospitals in his city and held membership in several specialistic societies. His family and friends may look back with pride on his long and useful career.

THE STUDENT'S LIBRARY

RESIDUAL NEUROMUSCULAR HYPERTENSION: IMPLICATIONS FOR EDUCATION. By *Josephine L. Rathbone.* Paper. Pp. 220. Price, $2.00. New York: Teachers College, Columbia University, 1936.

This book was prepared as a thesis for the degree of Doctor of Philosophy from Columbia University for which the author has prepared a study of great interest to physiologists, educators, and to a great extent also to physicians specializing in physical therapy. Essentially the volume is a research in the problem of abnormal fatigue from the physiologic, psychologic and clinical points of view. Even the influence of religion as a sort of psychologic support has not been ignored. The book is especially interesting because it rests not only on theoretic and practical studies of many investigators but on personal clinical observations of 75 patients, whose histories indicate the complex nature of abnormal fatigue due to residual neuromuscular hytension. Naturally the strictly medical aspect has been taken care of by physicians. Mention must be made of an especially interesting feature of this thesis that pertains to an effort to find all etiologic factors of the abnormality under consideration. Divided into six principal chapters, which in turn are subdivided, the last is entitled: "Implications for Education," which clearly suggests its interest to all engaged in educational work. The text proper concludes with a bibliography of no less than 507 references, which appear to have been actually utilized in the preparation of the text, and an appendix, the most interesting part of which is a detailed narrative of a patient as a diary, the symptoms and experiences dealing with the patients trouble being written up in narrative style. We recommend this book highly as an earnest and informative resumé of every known phase of the condition commonly grouped as fatigue.

A HAND BOOK OF OCULAR THERAPEUTICS. By *Sanford R. Gifford,* M.A., M.D., F.A.C.S. Professor of Ophthalmology, Northwestern University Medical School; Attending Ophthalmologist, Passavant Hospital, Wesley Memorial Hospital, Evanston Hospital and Cook County Hospital, Chicago, Illinois. Second Edition. Cloth. Price, $3.75. Pp. 341, with 60 illustrations. Philadelphia: Lea & Febiger, 1937.

That this edition has become necessary in four years, in itself is proof of merit. In its present form the book will be found more efficient than before. It is a concise book on ocular therapeutics, and describes only procedures the author considers valuable. Gifford believes that agents of value should not be abandoned in favor of new ones unless the evidence in favor of a change is convincing, while a position of therapeutic nihilism or of unreasoning skepticism with regard to new agents is equally fallacious. There is an excellent chapter on physical therapy which considers the following agents in ocular therapeutics, phototherapy, heat, cold, medical diathermy, surgical diathermy, roentgen ray, radium and massage. The author notes that ophthalmologists have been rather slow in making use of the modern physical agents owing largely to a proper fear of possible damage to the delicate structures of the eye, but in recent years we are able to say just what these dangers are, to arrange proper dosage so that they may be avoided, and to decide with some approach to certainty which conditions may be definitely benefited by these agents. The methods included in this volume are thoroughly modern. The book is highly recommended to all who treat diseases of the eye, specialists as well as general practitioners. Physical therapists will find in it material of interest to them either as consultants or as attendants for ophthalmologic affections.

HOME TREATMENT OF SPASTIC PARALYSIS. By *Percy Merritt Girard,* M.D., F.A.C.S., Chief of Orthopedic Service, Parkland Hospital, Assistant Chief Surgeon, Texas Scottish Rite Hospital for Crippled Children, Dallas, Texas. Foreword by *Earl R. Carlson,* B.A., M.S., M.D., Director of Department of Rehabilitation of Motor Disorders, New York Neurological Institute. Cloth. Price, $2.00. Pp. 130 with 77 illustrations. Philadelphia and London: J. B. Lippincott Company, 1937.

Carlson in his excellent foreword directs attention to the fact that when one considers all the waste among those not physically handicapped, and who, in spite of educational advantages, do not make good citizens, it does not seem unresourceful to devote more attention to intelligent "spastics," many of whom with proper training and guidance, might excel the average normal citizen. Girard has written this book for this very purpose of guiding and helping the parents of spastic children in carrying out the attending physician's directions for treating their child at home. It presents the result of experience with the therapeutic management of 875 cases of spastic paralysis. The drawings and the text describe in the simplest terms the directions to give the necessary exercises, speech training, relaxation and occupational therapy for spastic children. It can be highly recommended to the physician as a book to provide parents of such patients with study as a supplement to medical advice. All the exercises described in the book can be easily done at home without elaborate equipment. This particular feature alone renders

the small book very valuable to all interested in the successful management of a widespread and disabling malady.

SYNOPSIS OF DISEASES OF THE HEART AND ARTERIES. By *George R. Herrman*, M.D., Ph.D., Professor of Clinical Medicine, University of Texas. Cloth. Pp. 344 with 58 illustrations and 3 in color plates. Price, $4.00. St. Louis: The C. V. Mosby Company, 1936.

Of the diseases with which humanity is afflicted, none is viewed with greater trepidation because of its lightning and often tragic consequence than that associated with disturbances of the heart and arteries. And because of this somber background the profession has diligently collected and classified the symptoms of cardiopathy into tomes so ponderous and erudite as to make the average practitioner and student, beset by increasing responsibilities or an inexorable curriculum, despendent at the mastery of its context. The present volume is therefore timely and welcome because it has successfully bridged the gap between the highly specialized works that deal with the very minutiae of the subject and those that have presented a picture in strokes so broad or general as to render either one of questionable value for practitioner or student. The brevity and the very terseness of the exposition clearly indicate that the author has attempted to introduce the essential facts of the principles and modern conceptions of cardiologic practice and to leave theory and the speculative field to texts of broader scope. The work therefore offers in an epitomized and well indexed form a well-knit discussion of the important facts relative to causative factors, anatomic derangements, and physiologic and functional reaction associated with diseases of the heart and arteries. In the space of twenty-four chapters Herrmann has managed to contribute a clear impression of the scope of the subject, its analysis and management. The book covers methods of diagnosis and treatment by every recognized medium at our disposal. The chapters include such important considerations as the study of the suspected patient; the employment and interpretation of the various instruments used for this purpose (electrocardiography, radiography, and the like); classification of and disorders of the heart action; management of heart failure, be this of congestive, anginal or coronary origin; and the like. Space will not permit mention of the wealth of detail packed into the space of this small volume. The work presents as orderly an exposition of the essential data as is to be found in the larger text, but has the virtues of brevity, unity and clarity to such an extent as to make it an authoritative guide in the management of this serious problem in medical practice.

MEDICAL HISTORY OF CONTRACEPTION. By *Norman E. Himes*, Ph.D., With Medical Foreword by *Robert L. Dickinson*, M.D., F.A.C.S. Cloth. Pp. 521. Price, $7.00. Baltimore: The Williams and Wilkins Co., 1936.

This book comes sponsored by the National Committee on Maternal Health and presents in chronologic order an impressive history of contraceptive practice throughout the ages. It is the first in a series of three volumes outlined by the author in which the rich data on this timely subject will be interpreted. So far as concerns the present text, one notes with appreciation the painstaking and critical manner with which the available facts were reviewed and evaluated. As is well known a great deal of this practice has been surrounded in mystery and opposed by social and religious taboos, hence its exposition under critical and authoritative supervision is a welcome addition to scientific literature and medical practice. The subject matter is divided into six sections, the first concerning itself with a discussion of "Contraceptive Technic Before the Dawn of Written History," while subsequent ones carry the subject through the practices of the Ancients, the Middle Ages, and concludes with a discussion entitled "Democratization and Its Future." The early portion of the book abounds with references to contraceptive suggestions and practices which are in a limited sense as rational now as during the times of Soranos of Ephesus (98-138 A. D.), or even of those of the ancient Egyptian, Roman or Persian physicians. Often enough their methods in the light of present knowledge were highly amusing, superstitious and fantastic. The author reviews the evolutionary change of society during the eighteenth and nineteenth centuries when various individuals exerted their influence in arousing public interest with publications, lectures and legal entanglements, all of which disseminated the knowledge of contraception to the masses. There is evidence throughout the book of the author's conviction of the merits of this practice. The latter portion of the work deals with the sociologic and economic consideration of the problem. This, while illuminating and interesting, is not historical in the sense of a medical historical consideration of the subject, an objective expected from the title of this volume. Perhaps this feature will be more definitely stressed in the subsequent volumes. One closes the book with the conviction that the information contained therein is well selected, critically presented and of interest to both the special and general practitioner.

INTERNATIONAL ABSTRACTS

Treatment of Erysipelas with Ultraviolet Light. Norman Edwin Titus.

Brit. J. Phys. Med. **2**:104 (Oct.) 1936.

When this work was first started, the usual custom of recording dosage according to the time and burner-skin distance was followed, but later a more exact method was adopted, which is recommended. Since all mercury arc lamps vary in their erythema-producing time, it is considered necessary to mark the hood of each individual lamp with the exact erythema time for the burner contained therein. This being known, it is far better to prescribe so many times the erythema dose (E.D.) for each individual case. If such a system is followed, any operator knowing the erythema time of his individual lamp may expect to produce similar results. At the author's clinic the standard burner-skin distance is thirty inches, and each of the burners is examined with a Burt photometer every three months to check the calculated time which will produce a definite redness of the average skin.

Of 81 cases of erysipelas (41 females and 40 males) treated with ultraviolet energy alone, only two deaths occurred in infants, aged three weeks and two months, respectively, and were the only fatalities in sixteen children two years or younger, and twenty-six total cases in children seven years or under. Erysipelas of the face clears up quicker than the infection elsewhere on the body. Fewer total erythema doses and fewer treatments are required to reduce the temperature to normal in almost one-half the time. (Facial cases 3.59 days vs. 6.5 days for other infections.)

Ultraviolet energy should be prescribed in unit erythema doses (E.D.) adaptable to any burner, irrespective whether it is of hot or cold quartz type. Large doses, 16 to 20 E.D., should be given at the first treatment and may be repeated the next day.

Importance of Heat in Gynecologic Therapeutics. Kenneth J. Wilson.

J. Oklahoma M. A. **29**:440 (Dec.) 1936.

Diathermy is the most important form of heat therapy in gynecology with the widest range of application.

The physiologic effects of conventional diathermy and shock wave diathermy are clinically similar, although theoretically it appears that the latter would give better distribution of heat to tissues of different density or containing space. For ease and convenience of application short wave diathermy is the method of choice. Likewise, in acute gynecologic conditions attended with much tenderness it is more comfortable and pleasing to the patient. It is said to be particularly advantageous in pent up accumulations of pus. However, the author's observation of the relative merits of the two types of treatment in chronic pelvic conditions leads him to believe that conventional diathermy is equal if not superior when applied through a vaginal electrode. It is obvious that the short wave instrument is superior in the induction of hyperpyrexia, as it is capable of raising the body temperature several degrees in excess of that produced with diathermy.

Effect of Zinc Ionization and Galvanic Current On the Reaction of the Nasal Mucosa to Vasomotor Drugs. W. F. Wenner and J. H. Alexander.

Arch. Otolaryng. **24**:742 (Dec.) 1936.

Intranasal ionization with zinc sulfate is attended by destructive changes in the nasal mucosa (McMahon, Hollender and Gorin, and Smit). These changes consist of coagulative necrosis and desquamation of surface epithelium, atrophy and loss of glands, extravasation of red blood cells, leukocytic infiltration, fibrosis of the submucosa and thickening of the periosteum. Unless a chronic inflammatory process becomes established, the denuded epithelium is replaced by stratified dedifferentiated epithelial cells, which give rise to normal ciliated columnar epithelium from within six weeks to three months. During this time secretion is diminished because of the loss of functional secreting cells of the intra-epithelial and subepithelial glands. The mucosa presents a dry, shrunken appearance.

The shrunken, blanched appearance of the nasal mucosa, as observed clinically and experimentally, may be the result of several changes induced by ionization. Koeppen showed that a galvanic current of 24 milliamperes may produce complete paralysis of the vasomotor nerve endings and thrombi of the smaller vessels and capillaries. One of the authors showed that zinc iontophoresis stops the circulation of blood in the web of the frog's foot and in the external ear of the rabbit in from forty to sixty minutes. Clumping of the red blood cells was observed in the frog within fifteen minutes. Galvanic currents of the same intensities as those employed for zinc ionization (0.8 to 1.5 milliamperes) did not produce these changes. It is possible that the increase in connective tissue following zinc ionization interferes with the blood supply to the affected part.

Histologic examination of the nasal mucous membranes showed that up to six weeks the zinc-ionized membranes failed to respond to

either vasodilator or vasoconstrictor drugs. The nonionized nasal mucosa reacted to these drugs regardless of which side of the nose was selected for the first instillation. The vascular reactions of the ionized and nonionized mucous membranes to these drugs were the same three months after ionization.

The vascular response to vasoconstrictor and vasodilator drugs of the mucosa of cats subjected to the galvanic current alone was not elicited until four weeks after treatment. In these animals the vasomotor mechanism was similarly disturbed, but became normal apparently in a much shorter time. In both the membranes ionized with zinc and those treated with the galvanic current the presence of infection interfered with the vascular response of these tissues to drugs.

The pathologic changes observed in the zinc-ionized membranes were identical with those reported by other investigators. In addition to these changes there was found great osteoclastic activity in the turbinates of some cats one and two weeks after zinc ionization while in others synechiae were found. In all membranes treated with the parasympathomimetic drug mecholyl, there was a marked increase in eosinophilic leukocytes in the submucosa.

Depth Hyperemia. Contribution to Effect of Ultrashort Waves. Heinrich Gesenius.

Deutsch. med. Wchnschr. **62**:38 (Sept. 18) 1936.

The author reports highly interesting experiments on dogs undertaken to observe by laparoscopy the influence of cataplasms, baths, moor baths and diathermy on the production of deep hyperemia. In addition he reviews the results with short wave treatment on 427 patients, of whom 340 remained long enough under observation for a more or less conclusive study. While the experiments are of theoretic rather than practical interest, the clinical observations, evidently made without preconceived notions, represent a valuable contribution at the same time offering a definite solution to some of the moot problems. The overwhelming majority of the author's patients were women suffering from affections of the adnexa, and of these most were gonococcal in character. The observations are presented both in a special and in a general sense, the latter in the form of a parallel drawn with methods which were employed by other authors. Thus Gesenius points out that the striking results in the treatment of furuncles reported by Schliephake were not duplicated by so experienced a therapist as Kowarschik, without offering any explanation. In a terminology more drastic than scholarly he refers to hyperpyrexia even for paresis as "horse cures" with the word cure in quotation marks and a question mark. This is apparently mentioned to call attention to the "heroism" of a young woman who underwent the "Gewaltkur" (brute cure) solely because she hoped to get rid of her gonorrhea. He did obtain in her case an axillary temperature of 41 degrees C. (105.8 degrees F.). To avoid sweating which caused the patients burning sensations, he injected atropin. He does not recommend the heroic treatment by electrodes (felt pads) extending from the chest to the knees which are used for the treatment of paresis, for the treatment of adnexal infections. The author worked with a German-made 1500 watt tube apparatus of 6 meter wavelength. The table on which treatments are administered is covered by a glass plate, with an electrode, 22x27 cm., movably arranged under the table, and a smaller one above the table. An amperemeter is fastened to the upper electrode, in addition to which a neon tube is held on a rod, evidently with the intention of exerting a psychologic effect on the patients.

The rather lengthy article may be summed up with two conclusions. In the experiments it appeared by direct observation with a cystoscope-like instrument placed into the abdominal cavity that the old methods of applying warmth (cataplasms, baths and the like) are superior in effect to conventional and short wave diathermy and to cold red light treatment. The hyperemia in depth is explained as a sensory visceral reflex. Clinically, it appears that the objective findings are in a reversed ratio to the subjective phenomena — out of 340 patients (180 adnexal) palpation revealed improvement in 65, which finding is missing in the remaining 115, while in 113 patients subjective improvement was admitted. In 67 patients the treatment is accepted as a failure.

Treatment of Chronically Infected Prostate. Lorenzo F. Milliken.

Pennsylvania M. J. **39**:791 (July) 1936.

Davis, Thompson, Cook, and others have reported drainage of the infected prostate by transurethral incision of the posterior vesical lip with the Collings knife, or by exposing infected areas of the gland by means of the wire loop or punch. This method should obviously be of value in those cases of infection in which there are definite cavities in the prostate as indicated by depressed areas after massage. This method was not tried except where infection was present in addition to obstruction; but while drainage of any cavities might thus be facilitated, it is not likely that the prostatic drop would be free of pus as the result of such treatment, unless all infected acini could be removed by resection, and this would not be feasible.

A satisfactory electrode has not yet been devised for the diathermic treatment of prostatitis. Considering the variously shaped and sized prostates, the probability of properly generating heat in the gland with any electrode on the market is questionable. The degree of heat cannot be definitely estimated, for a thermometer in the electrode cannot register correctly the temperature in the tissues. The author has long since discarded diathermy in any stage of prostatitis.

The use of hot solutions in the rectum remains the only means of applying heat successfully. There is no doubt that properly applied and controlled heat in chronic prostatitis is helpful, for it inhibits, attenuates, or destroys infective organisms, promotes secretion and drainage, speeds the

absorption of inflammatory infiltrations by improving the circulation, and relieves pain and irritation. Hot water and saline solution have been used as small enemata which are retained for a few minutes and then expelled. It has also been used through the metal psychrophore, through various rectal tubes with recurrent flow, and in the Elliott apparatus, which circulates hot water at constant temperature through a rubber bag in the rectum.

The construction of a double bag to replace the Elliott bag makes possible the application of any degree of heat desired to the rectal side of the vesicles and prostate, while tepid fluid circulating in the posterior cavity protects the normal rectum against possible ill effects of heat. If it is believed that heat will not injure the rectum, then only the anterior bag need be filled and there will still be 3 layers of rubber to protect the posterior wall of the rectum. Two irrigating reservoirs and a receptacle to collect the return flow are needed. The temperature of the hot water can be taken occasionally in the reservoir and as it returns from the rubber bag and thus can be adjusted to any degree desired. This will require a little time and attention, but there should be compensation in being able to apply any degree of heat to the whole prostate and the seminal vesicles and in the possibility of applying safely a higher degree of heat than has heretofore been used.

This double bag can also be employed for the alternate use of hot and cold water which alternation will stimulate the circulation more effectively than heat alone. The cold water may be secured by putting ice in the reservoir. First, the use of cold water for 15 minutes, then of the hot (120 to 130 F.) for the same period, repeating alternately so that treatment will be continued for one hour, is the method selected until experience suggests variation.

Theoretic and Practical Advantages of Short Waves of Six Meters.

Radiol. **20**:107 (May 1) 1936.

When high frequency currents are passed through human tissue, a diagrammatic representation might show a series of resistances in parallel with a series of condensers as the course of the electric circuit. Part of such a current would traverse the resistances and produce heat. Another component would enter the condensers and charge the condenser elements, with a resultant displacement current which would not produce heat. But as the frequency is increased, this displacement current will provoke heating due to a phenomenon called "dielectric hysteresis." Whereas the ohmic resistance of the tissue remains constant with variations in wavelength, the condenser or capacitative factor will offer a resistance which decreases with the frequency. This capacitative resistance is termed capacitance, and since a 6 meter wave has a capacitance of only one-tenth that of a 60 meter wave, it will permit the passage of ten times as much current. The geometric sum of the ohmic resistance and the capacitance is known as impedance and it diminishes as the wavelength decreases. Each kind of tissue has a specific impedance. Muscle has a low resistance and almost no capacitance. Fat and bone have more or less resistance but high capacitance. If a high frequency current of long wavelength is passed through fat and muscle in series, the capacitance in the fat will be so high that most of the current will flow through the resistance element of the fat, with consequent heat formation and dissipation of so much energy, that little will reach the muscular layer. If the frequency is raised sufficiently, the capacitance will be so much lower, that enough of the current will pass through the condenser elements of the fat to allow for deeper penetration. Upon this reasoning is based the fact that tissues are heated more evenly and deeply at ultrahigh frequencies. There is the mechanical advantage of electrode spacing. The resistance of the air is such, that the lines of force entering the treated part will be as straight with a 3 cm. spacing in 6 meter applications, as can only be accomplished in 15 meter machines at 12 cms.; and, the further the electrodes are from the treated part, the greater the energy losses. Thus a 6 meter wavelength will permit of more even and deeper heating with less energy loss than will a longer wavelength.

Electrotherapy in Endocervicitis. A. M. Dearman.

West Virginia M. J. **32**:458 (Oct.) 1936.

Dearman has used the Cherry electrocoagulation treatment on 269 cases. Only twice was it necessary to repeat the treatment for complete healing of the endocervicitis. Cauterization was used on seventy-one patients requiring a repeated treatment thirty-three times, making a total of 104 cauterizations. All coagulation treatments were given within the last two and one-half years. Seven have since become pregnant. Two have been delivered with no evidence of dystocia. One case of unrecognized pregnancy was undisturbed. Should an acute condition of the pelvis develop following cauterization or electrocoagulation, it should be treated as any acute pelvic condition, such as follow abortions or deliveries. The author's preference would be the Elliott treatment, with no rush to open the abdomen and, if abscess formed, drainage if possible by posterior vaginal section or Cullen's method. There is one variation in his later care of the patients from other reports he has studied. He instructs them to wash frequently but not to take douches. He makes no effort to remove the coagulum but dilates the canal with a small applicator with tincture of iodine. Before the first treatment he cleanses the cervix with an antiseptic and uses 15 per cent cocaine. Treatment is somewhat painful, but the pain lasts only about half a minute. Ideal results with the cautery require greater skill than with the Cherry treatment. Stenosis is due to overcauterization into muscle, and recurring endocervicitis is due to undercauterization that does not reach the diseased glandular tissues. Treatment of the cervical canal to within one-eighth inch of the in-

ternals is necessary for cure. This is more difficult when accomplished with the cautery. In the Cherry cases there were two cases of mild cervical stenosis that were relieved easily by one dilation at the office. — J. A. M. A. 107:1760 (Nov. 21) 1936.

Diathermic Treatment of Giant Holes in the Retina. H. Weve.

Arch. Ophthal. 16:173 (Aug.) 1936.

In all the cases described Weve used the combined technic of surface coagulation, which he first described before the meeting of the Netherlands Ophthalmologic Society on June 1, 1930, and multiple perforating microcoagulations, which he later described in a monograph. The combined technic of surface and perforating coagulation has been completely successful in the following cases: 72.5 per cent of 71 cases in 1933, 75 per cent of 76 cases in 1934 and 80 per cent of 133 cases in 1935. In at least 50 per cent of the cases the condition was complicated.

Two technical details were largely responsible for the success achieved: First, ophthalmologic control during the entire course of the operation and, second, the method of localization of the holes by transillumination. The operator looks at the hole with an ophthalmoscope, and the assistant marks the center of the illuminated area on the sclera. A strong source of light, an inverted image and a lens of 20 diopters — in other words, indirect ophthalmoscopy with a stronger focal lens — are employed.

Directive Influence of Light Upon Drosophila Melanogaster Meig and Some of Its Eye Mutants. Frank A. Brown, and B. Vincent Hall.

J. Exp. Zool. 74:205 (Oct. 5) 1936.

The directive effect of white and colored lights upon drosophila melanogaster Meig, and three eye mutant stocks, has been measured with apparatus and methods yielding results not complicated by the effect of light upon the activity of the flies. The threshold of response to white light for the red full-eyed flies was 0.0001 f.c.; for the white full-eyed ones, 0.00058 f.c.; for the white bars, 0.09 f.c.; and for the red bar flies, 0.178 f.c. Assuming that facet number is directly related to the surface area of the bar and full eyes, the logarithm of the threshold of response and the strength of the tropistic response appear to vary linearly with the facet number. Experiments with colored lights indicates that the presence of red pigment in the eye is coincident with a comparatively greater sensitivity in the regions of the spectrum of shorter wavelength than about 5,000 A. At the same time a slight reduction of sensitivity to the longer wavelengths may occur. Bar-eyed flies are apparently relatively more responsive to red and blue-violet light and less responsive to blue-green than full-eyed flies. Barring appears to have less effect upon the sensitivity of the unpigmented eye to ultraviolet than it does in the case of the pigmented eye.

Short Wave Diathermy Treatment of Chronic Sinusitis. Oliver C. Nickum.

Nebraska M. J. 22:14 (Jan.) 1937.

Forty-five cases of chronic sinusitis have been treated. The type of machine used was that fixed at a 9-meter wavelength, using air spaced electrodes, with the dosage as to length of treatment and intervals determined by the patient's tolerance.

The patients ranged in age from thirteen to sixty-five with symptoms having existed from a few months to as long as fifteen years. The majority had been treated by other means, some conservatively and some more radically, so that others had also sustained the diagnosis of sinus trouble. Fifteen treatments was set as a minimum and a number of cases were given as many as fifty. Several medical students and physicians were invited to accept treatment in order to add a more critical group. The decision as to recovery aside from the disease in subjective complaints was the clearing of inflammatory appearance of the nasal and post-pharyngeal mucosa. The gradual decrease in post-nasal drip and its change from a thick tenacious type to a clear watery form was suggested to the patient as a guide to progress. An oily spray with one per cent ephedrine was used before treatments.

Short wave therapy in sinus infection has the property of producing heat to tolerance plus the effects of increased phagocytic action and lymphatic drainage. Local sinus treatment in any form should accomplish shrinkage of the membrane to promote drainage; the destruction of pathogenic bacteria and stimulate restoration of function. All cases treated showed symptomatic improvement, flare-ups in secondary foci were accepted as evidence of more than symptomatic response.

Roentgen Irradiation of Eyes Blind from Absolute Glaucoma. W. Kreibig.

Wien. klin. Wchnschr. 49:843 (July 3) 1936.

The literature on the subject is reviewed by the author. At the Vienna general hospital roentgen treatment is given by repeated small doses. At intervals of a few days, 50 roentgens is administered until a total of 150 roentgens has been reached. Atfer this course and a rest of one to two weeks a further series are administered. The pain was reduced in a number of patients, but there was no reduction in intraocular pressure. It is possible that the value of roentgen therapy can be ascribed to the fact that the roentgen rays render the eye insensible. The author believes that a trial of roentgen therapy is justified in cases of painful absolute glaucoma, that patience is necessary in spite of some failures, that improvement is sometimes not observed until six or more treatments have been given.